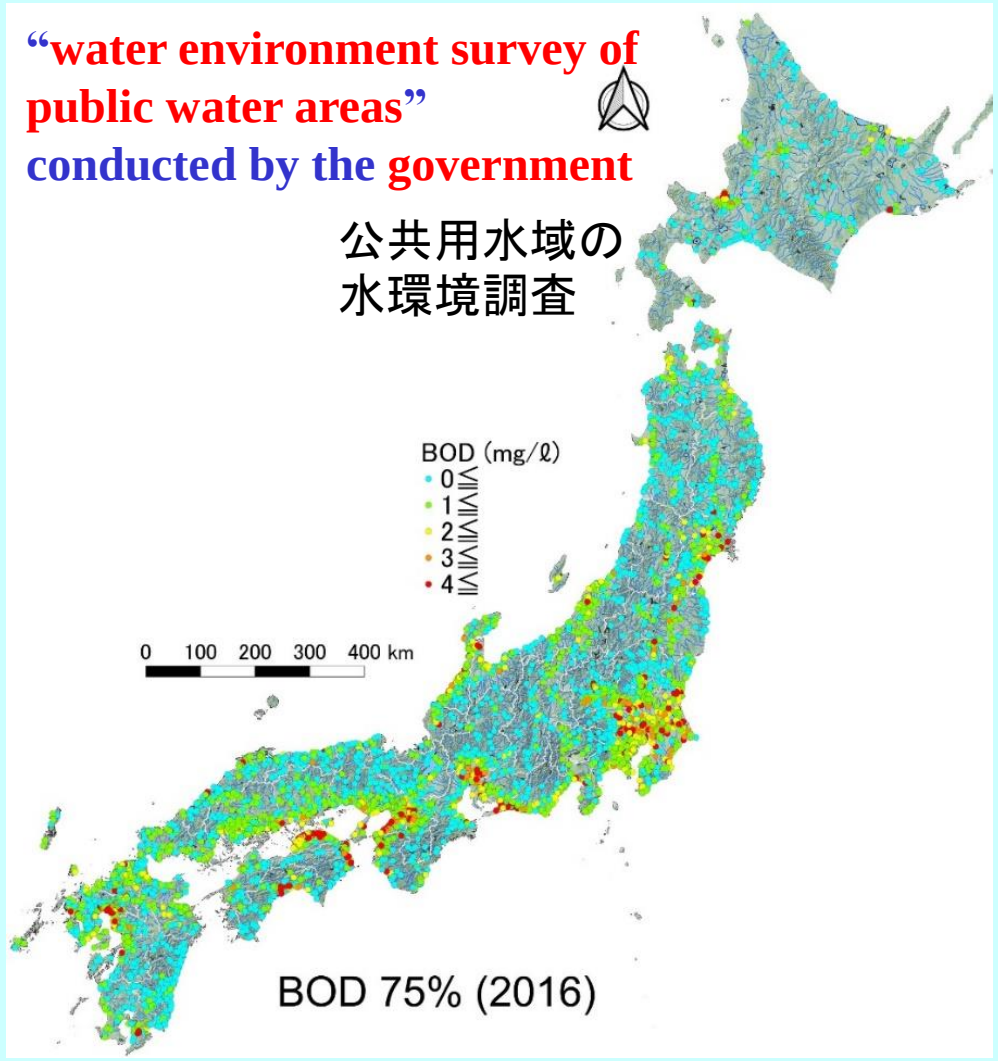
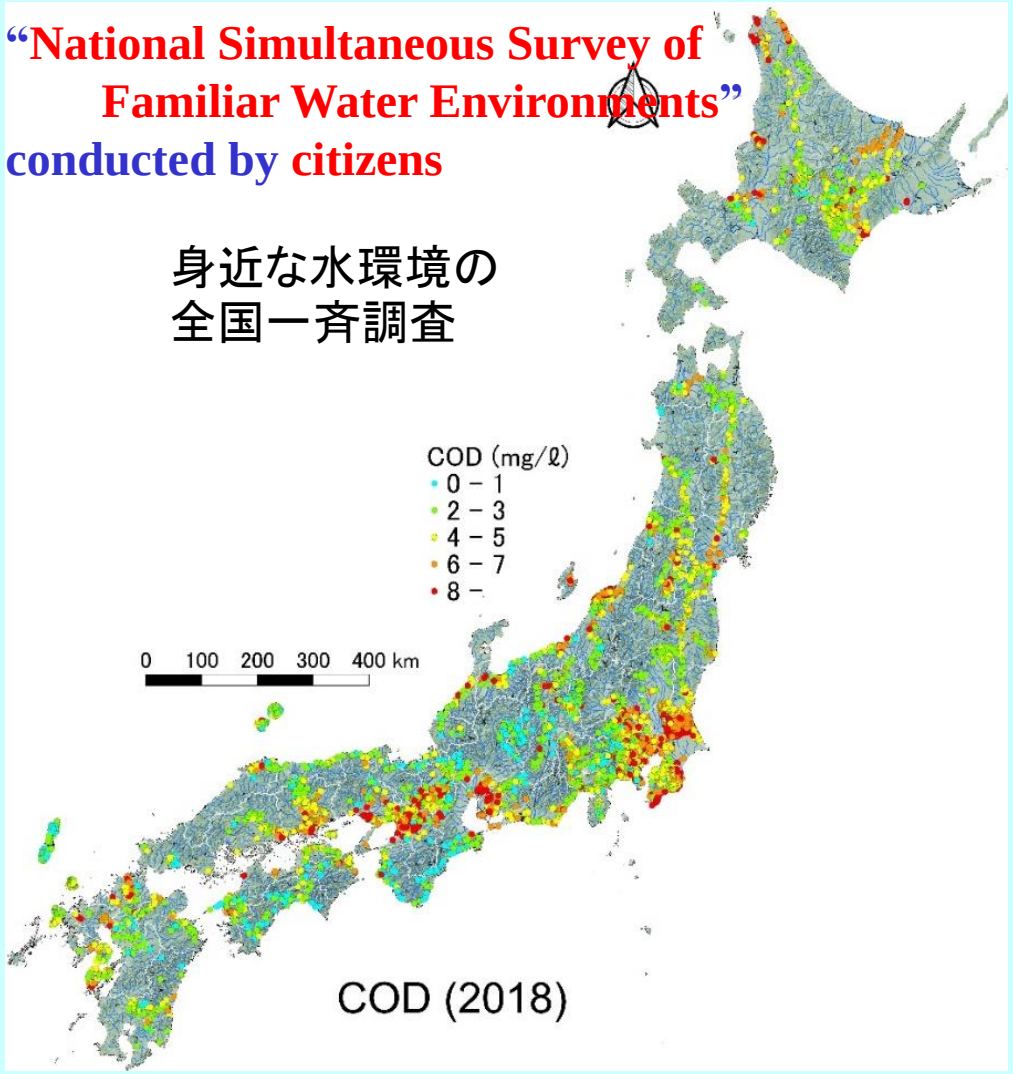
Study on long-term variation of river water quality in Japan





KODERA Koji（Hosei Univ.）・ODA Masato（Chiba Univ.）
・IGARI Yoshihiro（Nippon Koei Ltd.）・MORIMOTO Yoichi（Japan River Front Research Center）

Introduction ＜Overview of River Water Quality in Japan＞

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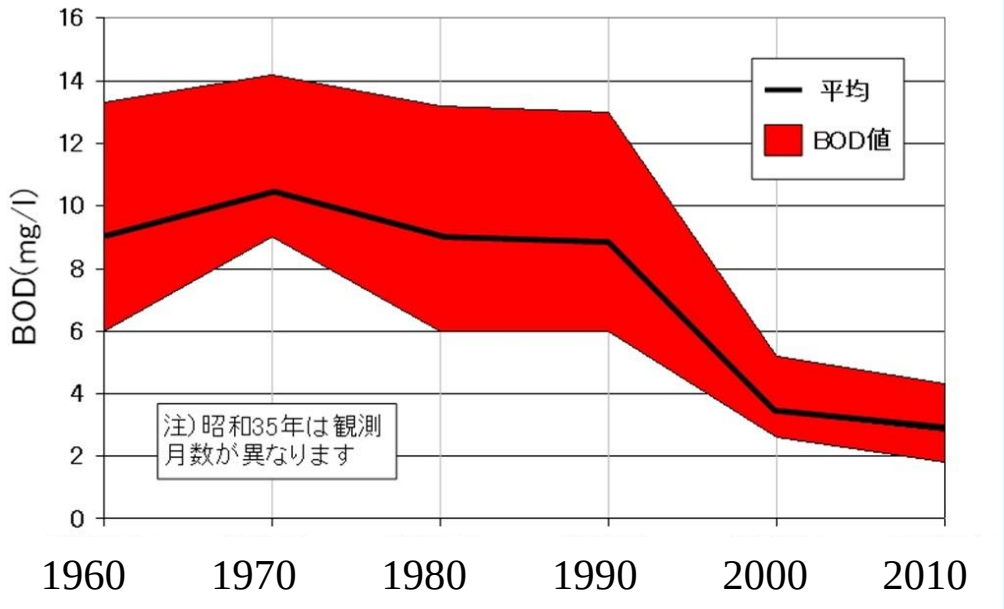
Water pollution during the high-growth period (1950s～1960s) was improved by legislation (Water Pollution Control Law, 1970, etc.) in Japan

Point source pollution → **Non-Point source pollution**

However, when **viewed on a nationwide scale**, there are areas where improvements have not yet been made, and further measures are needed.



Long-term changes in BOD (Yodo River: in Osaka)

① **Small Villages** with **Inadequate "Wastewater Treatment"**

② Problem of "**Basin sewage system**", "**Community drainage**"

③ **Rapid urbanization** while **farmland remains**
Suburbs of big cities

Local contamination remains and is not easily improved

→ **What should we do**?

Discovery of **hidden point source contamination**

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Method ＜to find hidden sources of pollution＞

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① Analysis of the results of the “water environment survey of public water areas” conducted by the government （1970～ ）

② Analysis of the results of the “National Simultaneous Survey of Familiar Water Environments” conducted by citizens （2004～ ）

③ "Restoration of water quality before 1971" without continuous records From various literature and records

④ In particular, analysis of the 2020 and 2021 results of our laboratory‘s "Simultaneous Survey of Familiar Water Environments"

① Analysis of the results of the "water environment survey of public water areas" conducted by the government (1970～)

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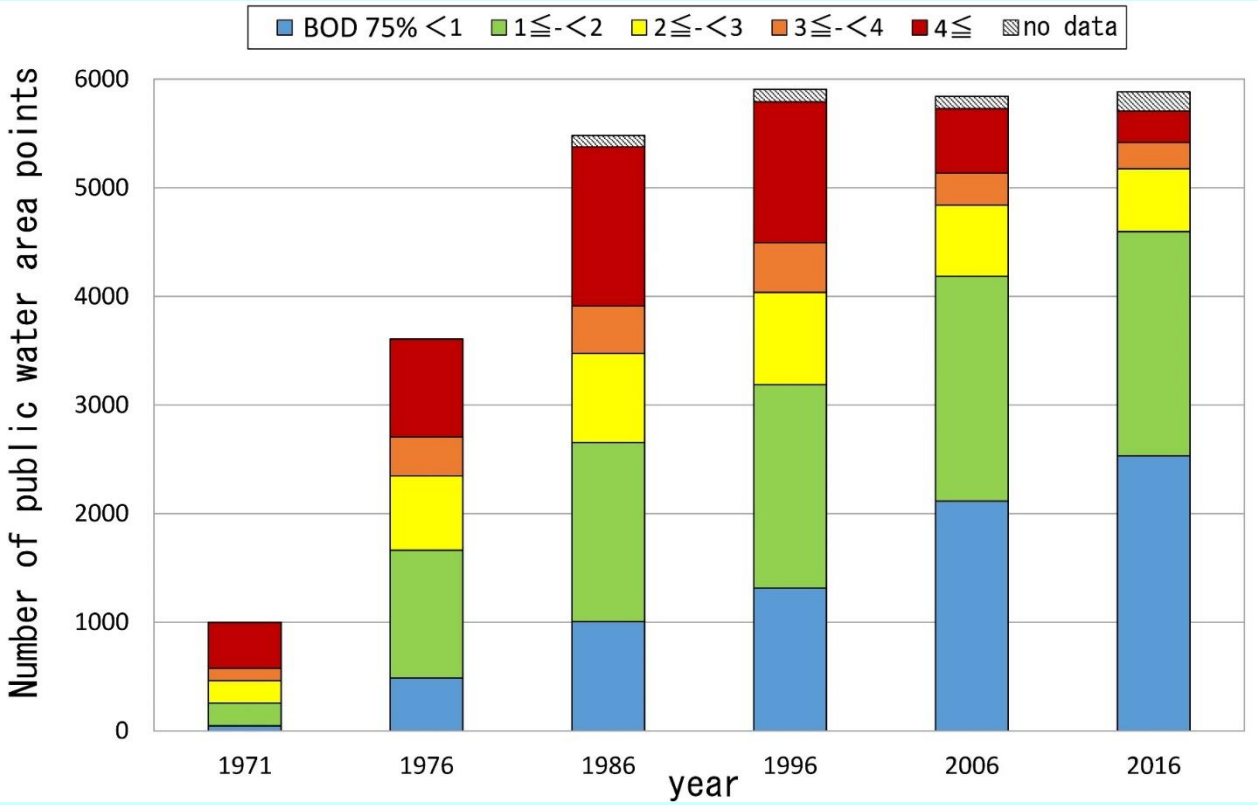
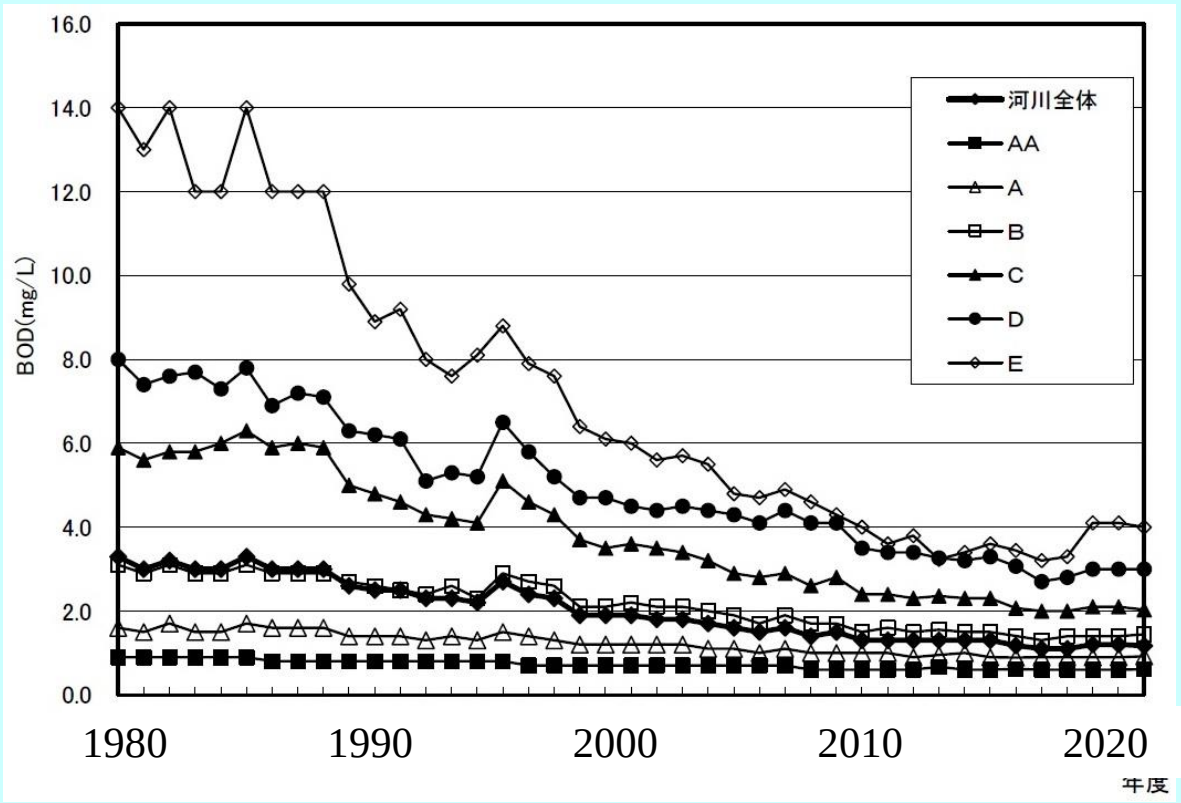


Changes in the number of survey points and water quality



Changes in water quality by river classification

Observation points were established in the **1980s**, but the number has not changed since then.

Water quality improved dramatically **But not much has changed since 2016**

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In particular, it has improved significantly since 2006

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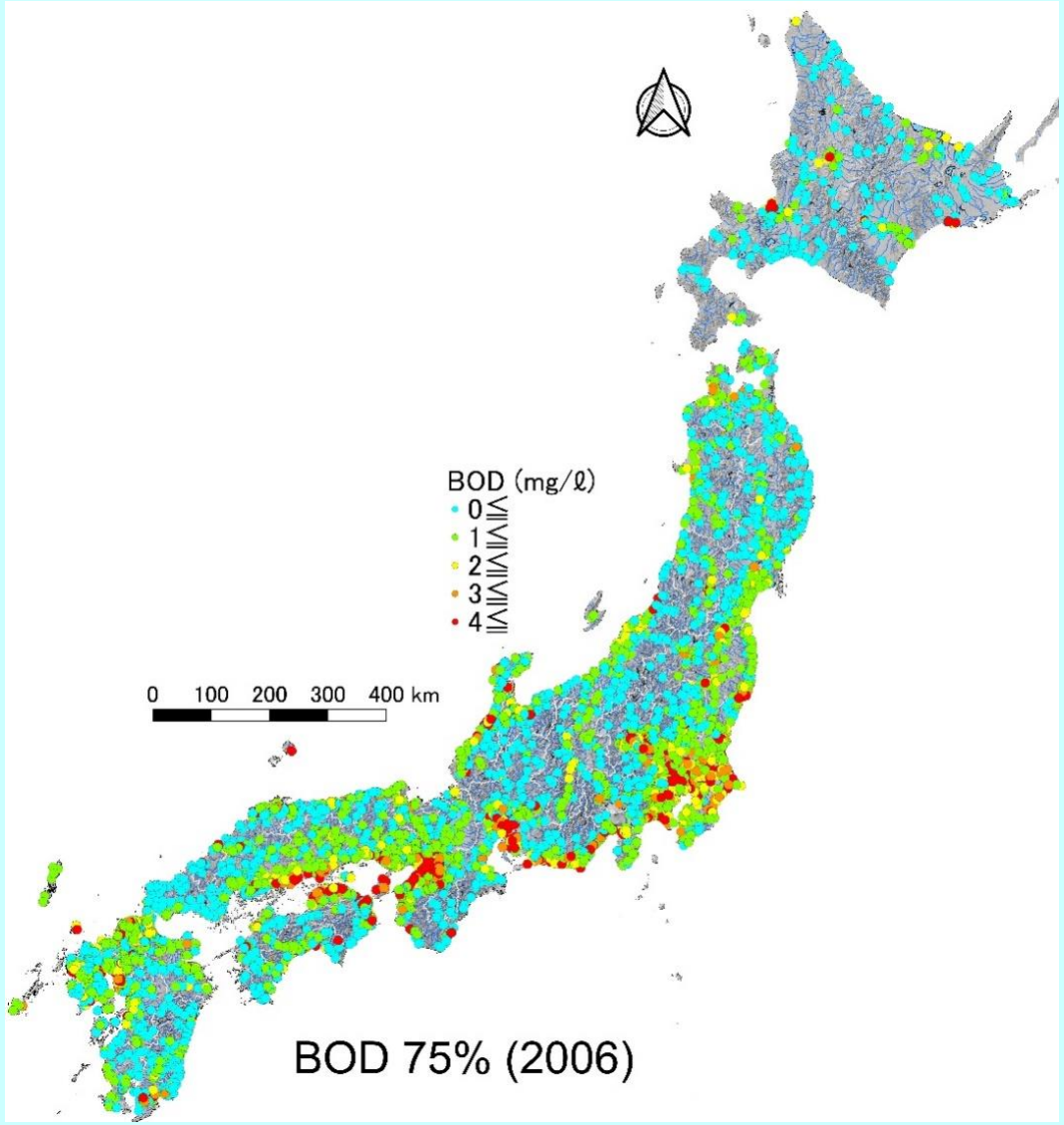
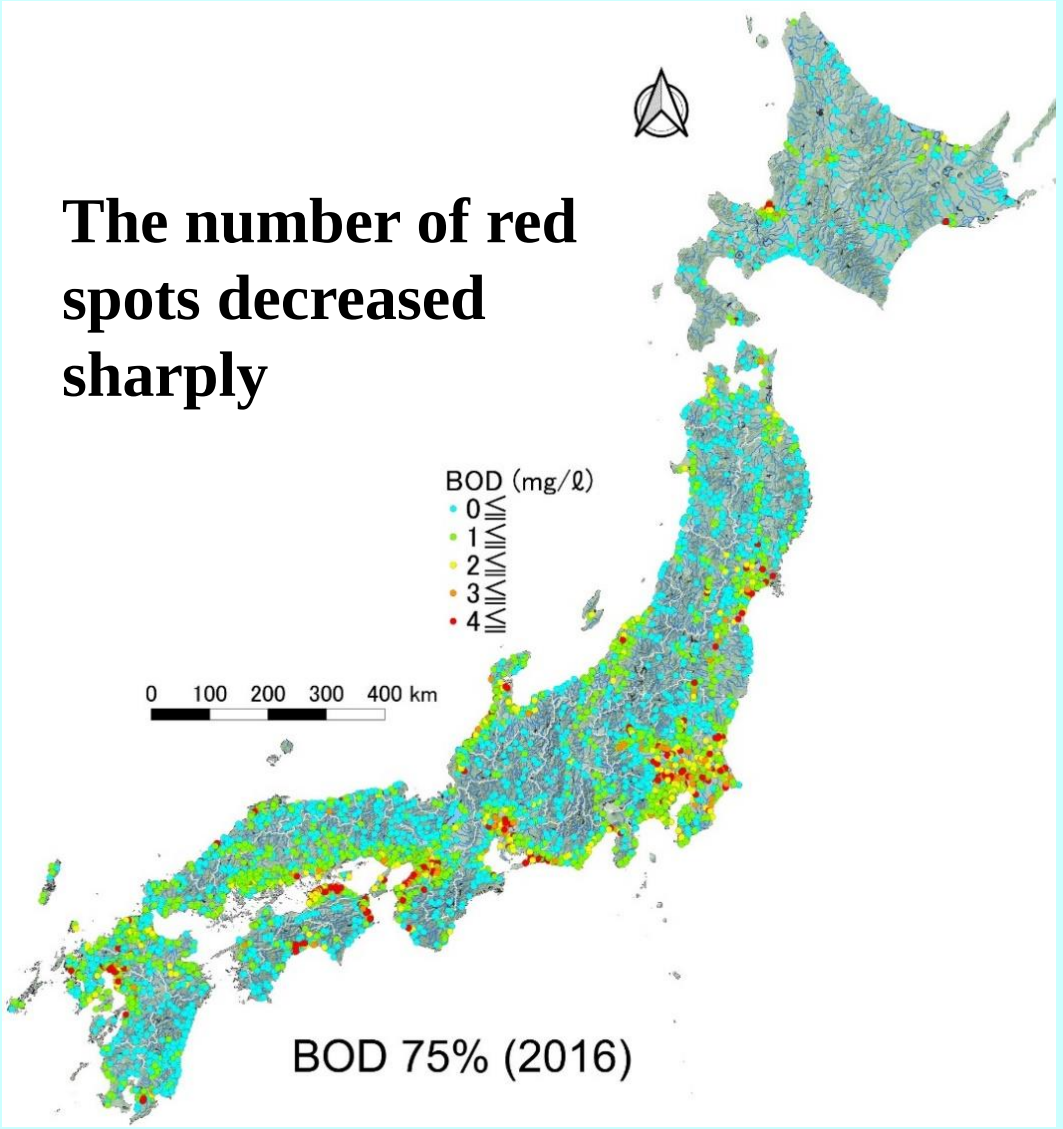


The number of red spots decreased sharply



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② Analysis of the results of the "National Simultaneous Survey of Familiar Water Environments" conducted by citizens (2004～)

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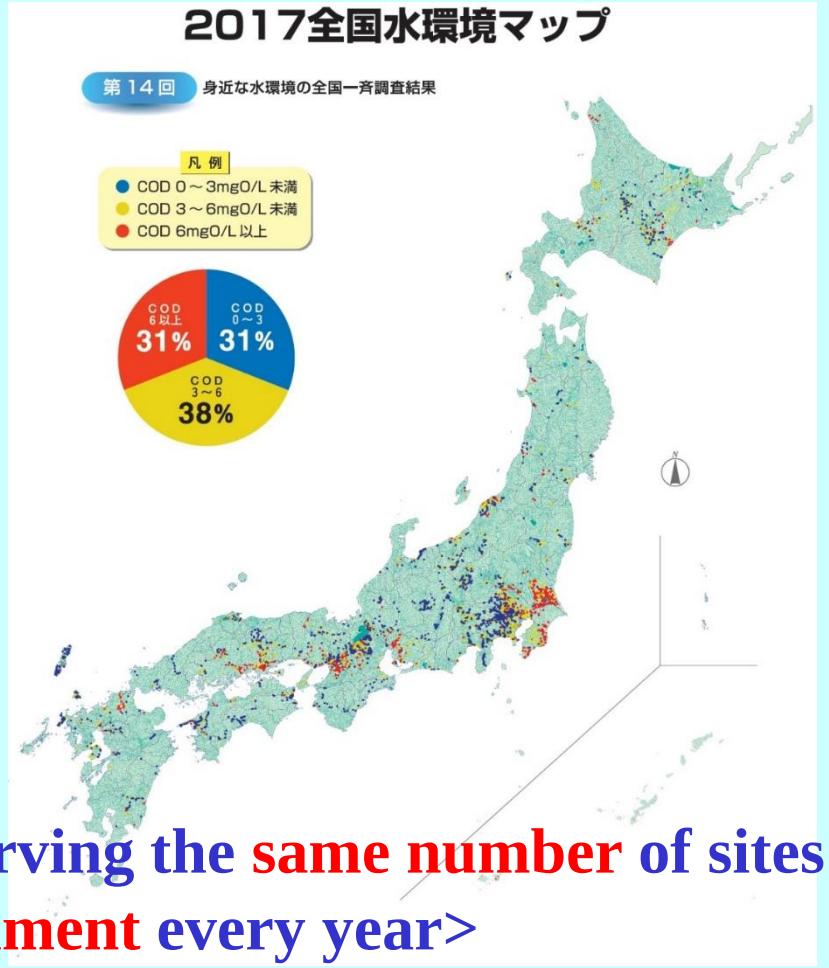

As a real feeling, the familiar water environment has not improved, Citizens start observing

<Observing the same number of sites as the government every year>

⇒ There are still many spots with poor water quality

Changes in the number of sites and water quality by year

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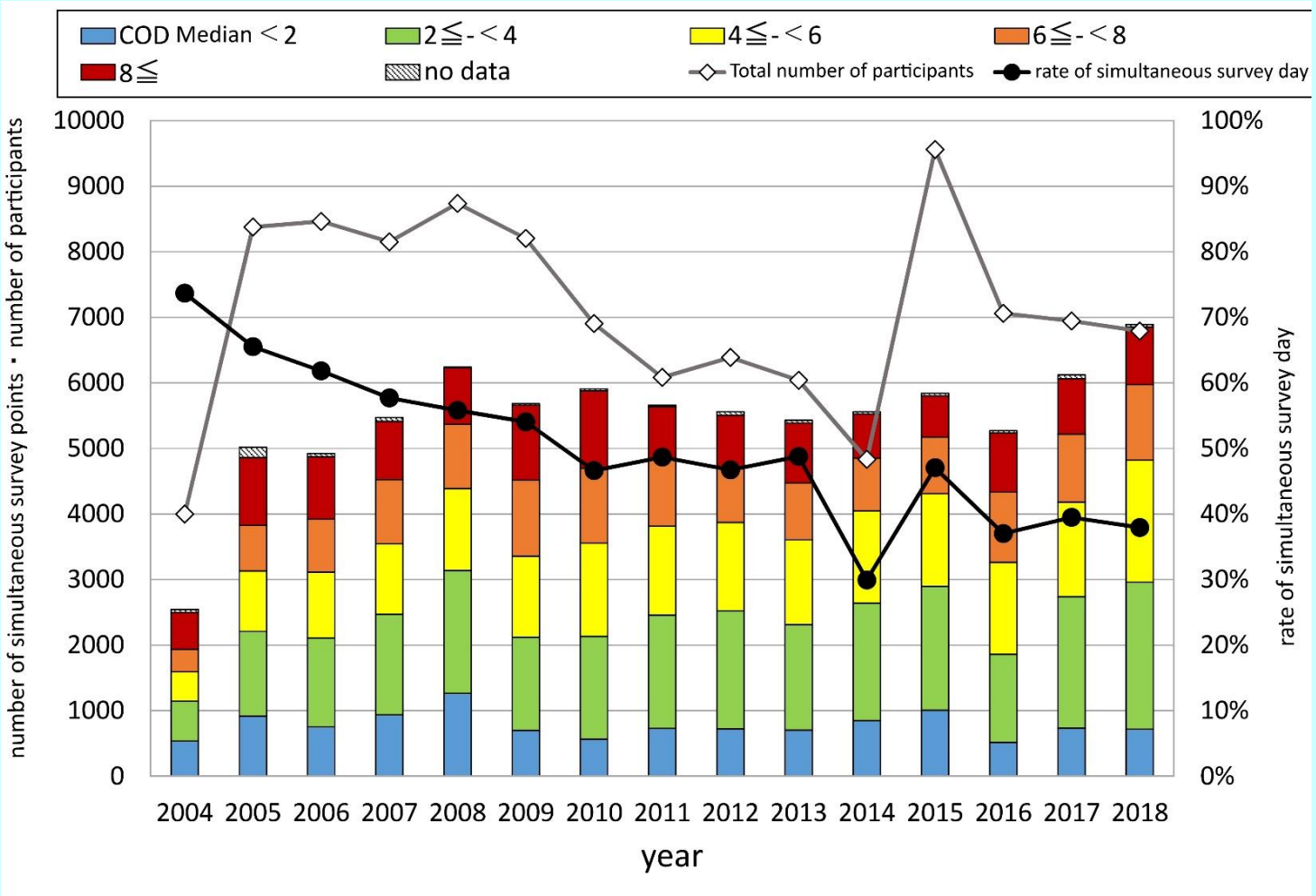

Since 2005, more than 5,000 sites have been surveyed every year, but the water quality has hardly changed

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Differences between government and citizen survey results

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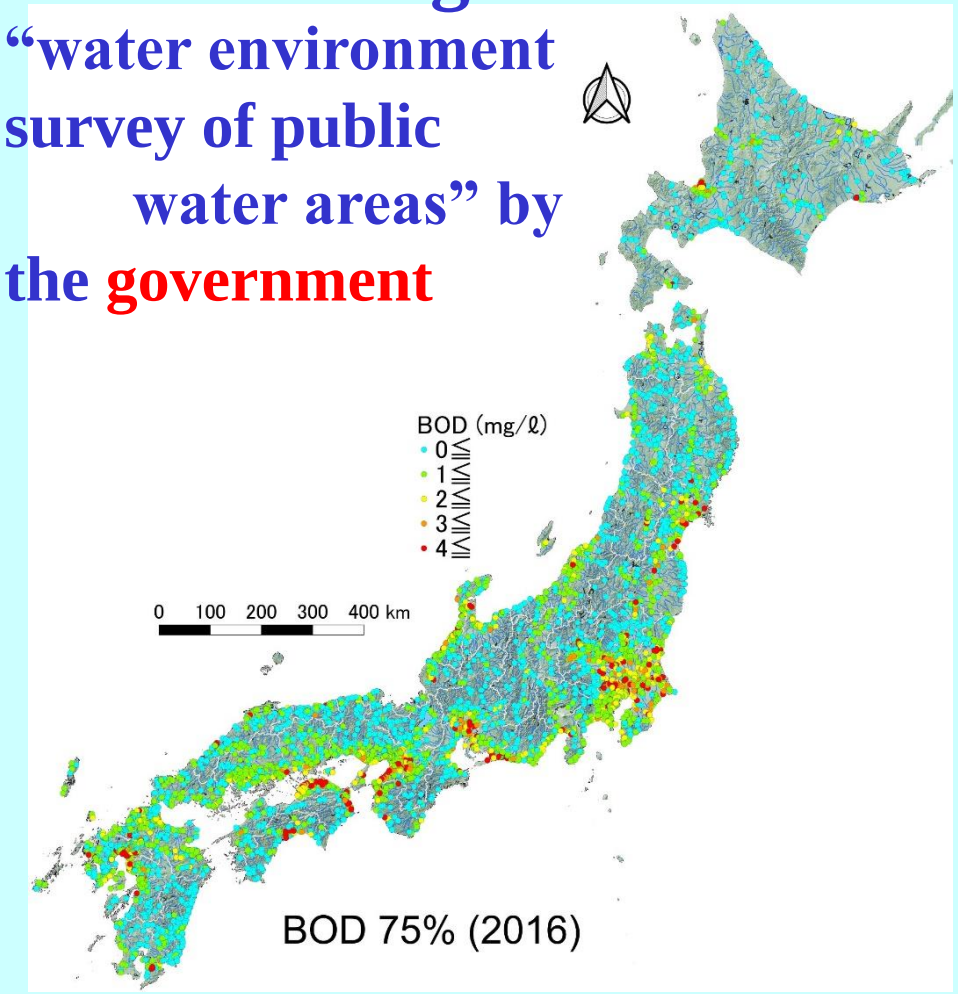
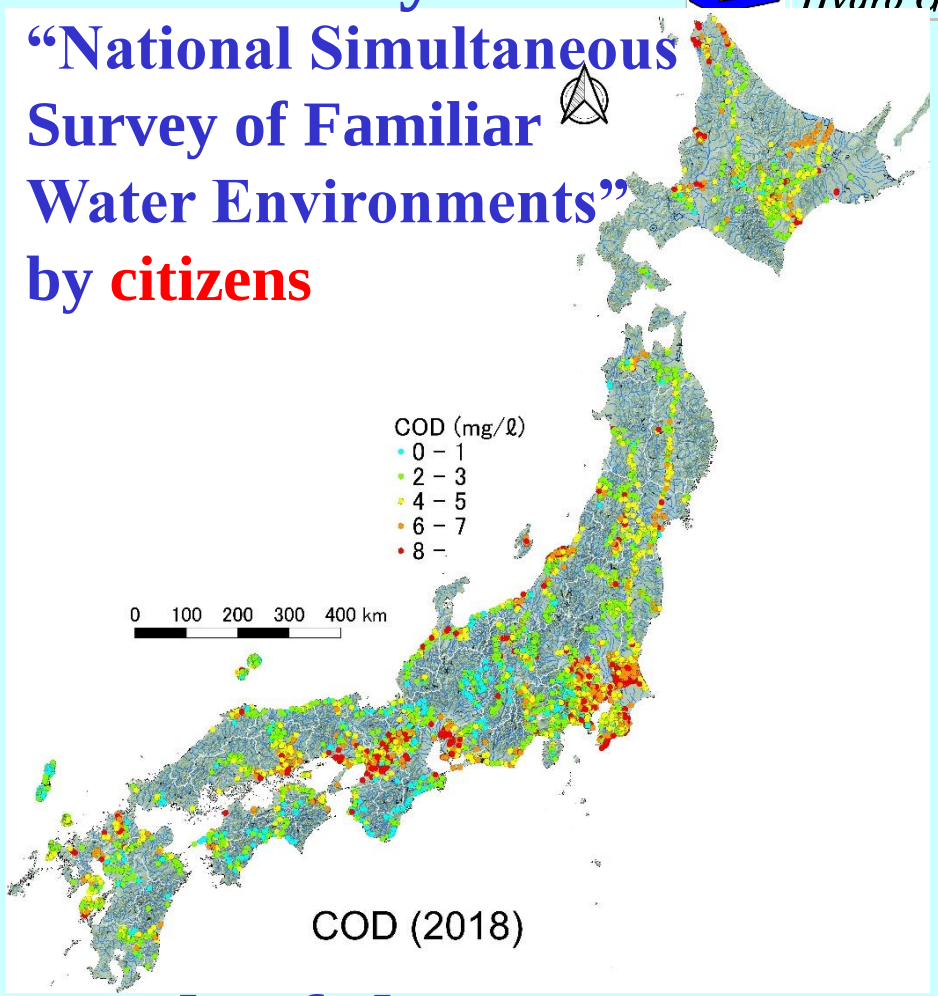
"water environment survey of public water areas" by the government



"National Simultaneous Survey of Familiar Water Environments" by citizens



Spatial representation is the result of the government, feeling is the result of the citizens

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Analysis of the oldest national survey（Kobayasi,1958）

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＜Problems in data analysis＞

① Accurate identification of survey points is difficult

② The measured water quality is mainly composed of major dissolved components, and there are no pollutants.

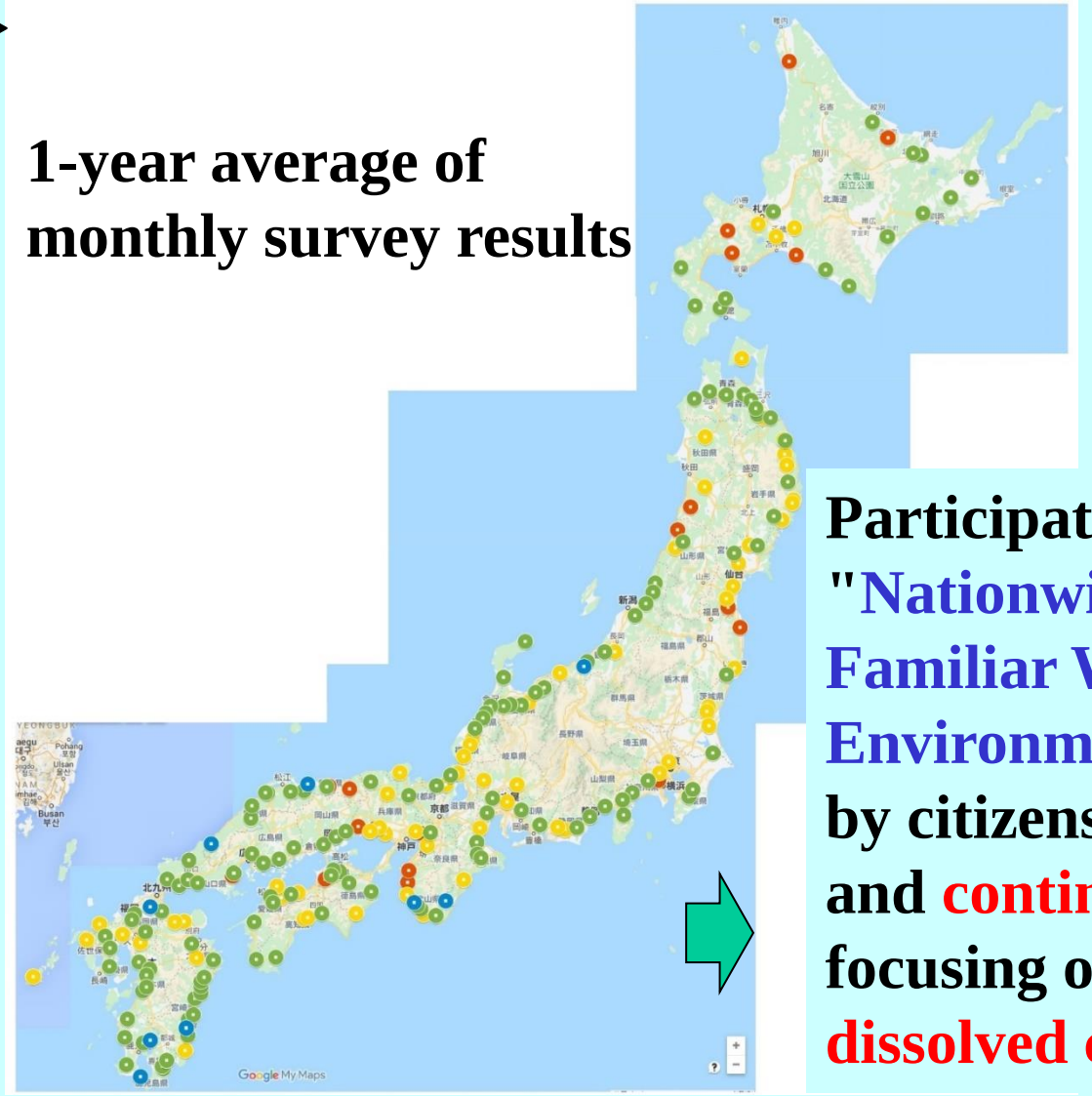
↓

It is difficult to analyze the same water quality at the same point, at the same frequency

↓

We have to find new ways to compare changes in water quality

1-year average of monthly survey results



Confirm	19
almost certain	64
difficult to identify	132
Not identifiable	10
Total	225

Participate in the "Nationwide Survey of Familiar Water Environments" conducted by citizens, obtain samples, and continue analysis focusing on major dissolved components.

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For nationwide comparison, my laboratory supplements prefectures with few survey points

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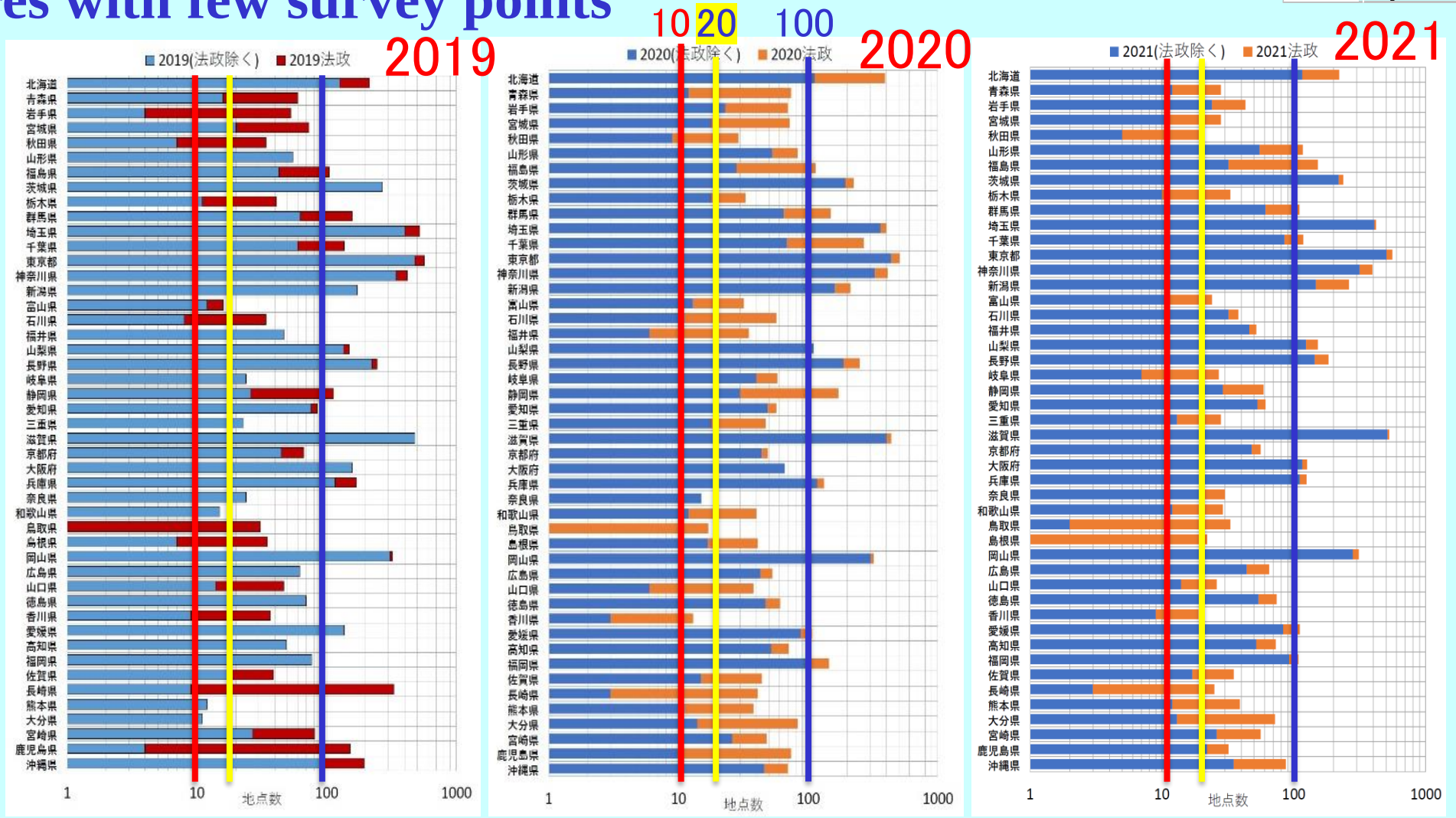

More than **20 points** in **each prefecture** in total, more than **10 points for sampling**

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Changes in the total number of sites and the number of sites in my laboratory

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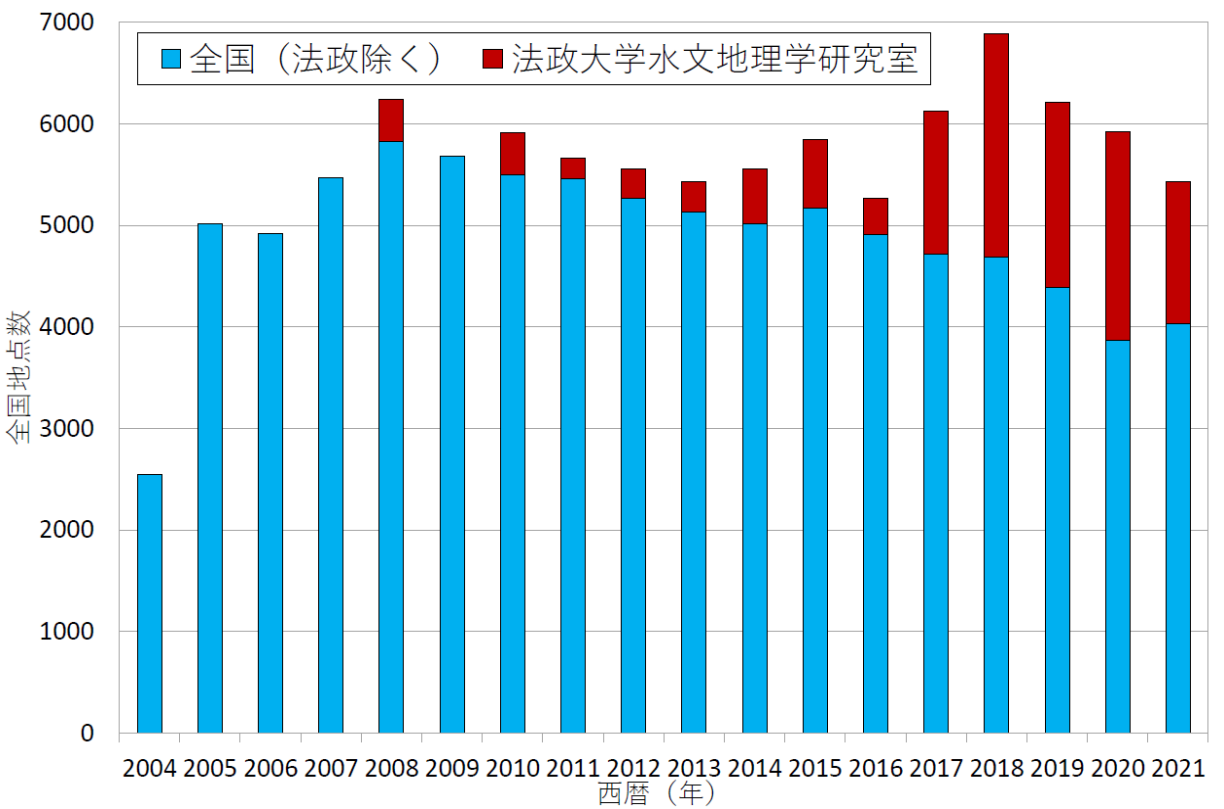

It helps to stop the decrease in the number of survey points, but the continuing decline in surveys by citizens is a big problem

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Differences in Survey Locations by Year

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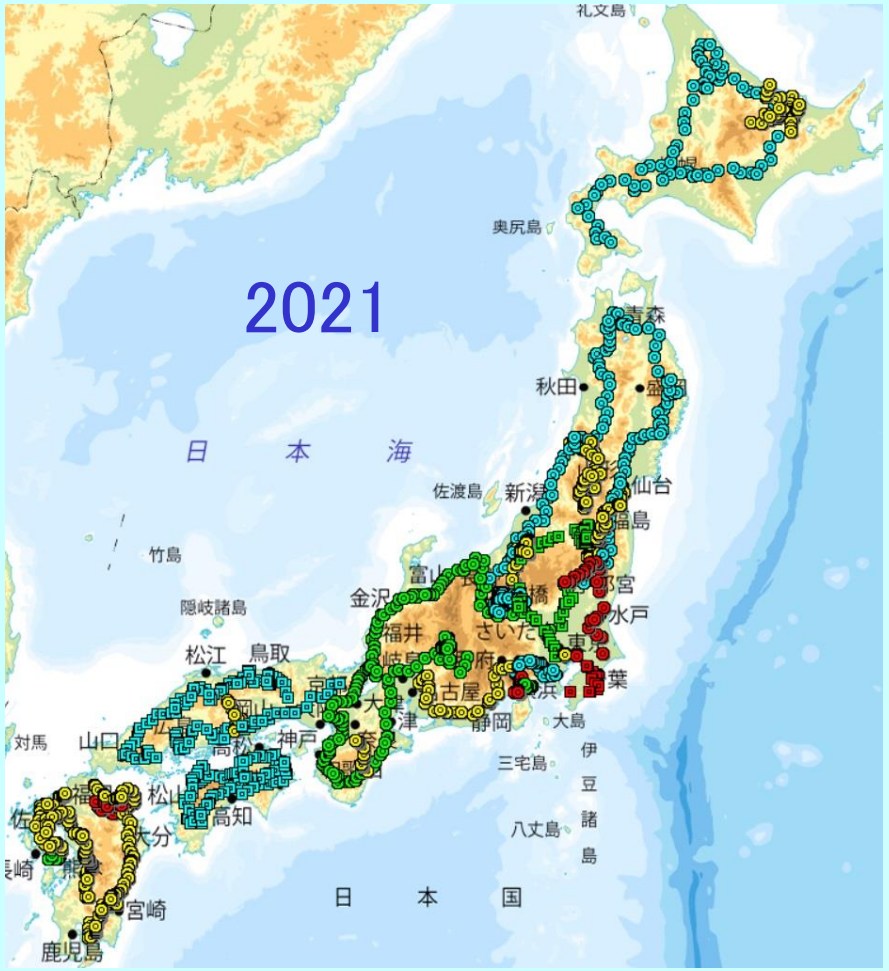

1,500 to 2,000 points are surveyed every year, 8,000 points are surveyed in 5 years, and surveys are repeated every 5 years （some points repeat every year)

Number of survey points by prefecture in my laboratory

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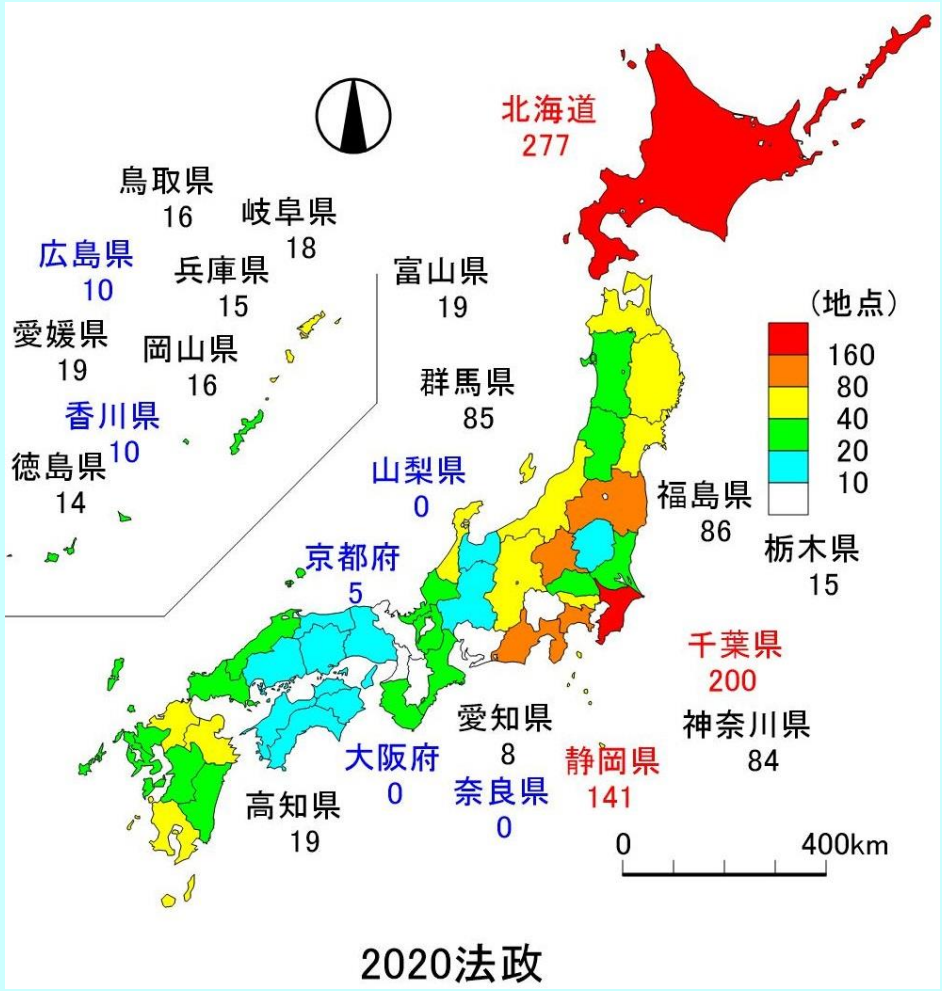

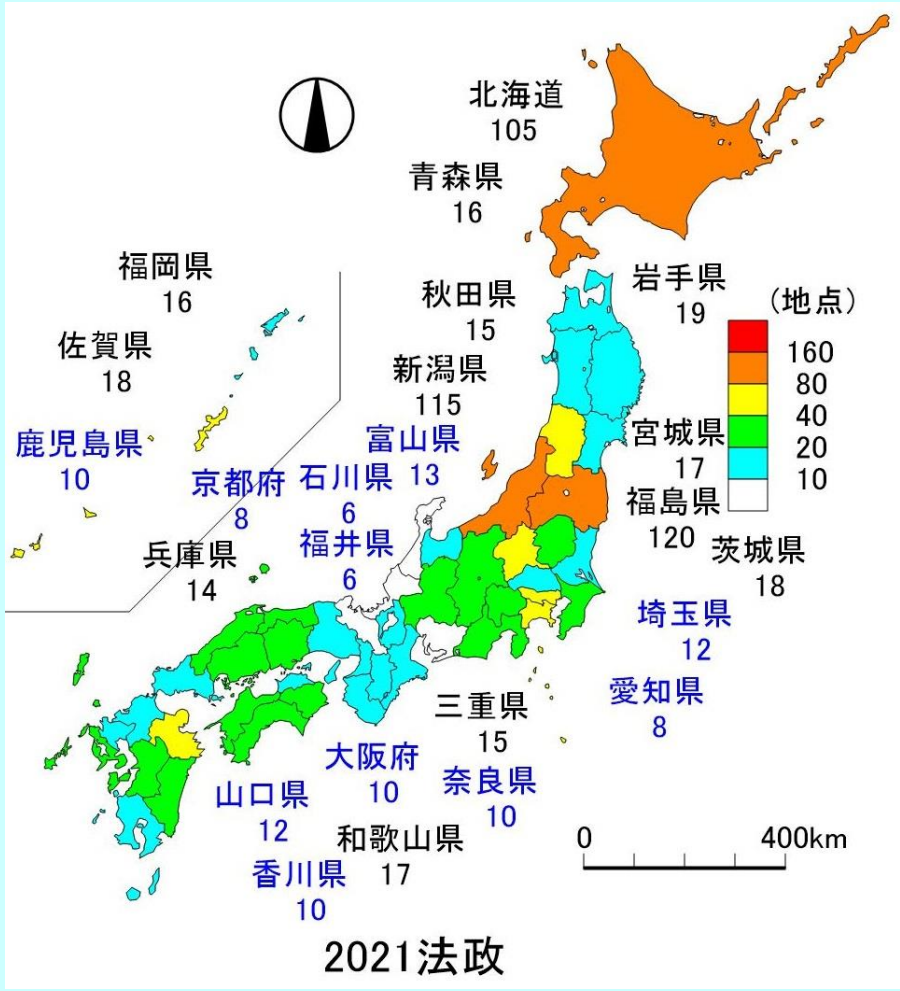

Unfortunately, 3 prefectures could not be surveyed in 2020, and 4 prefectures will have 10 or less points in 2021

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Comparison of water quality in 2020 and 2021

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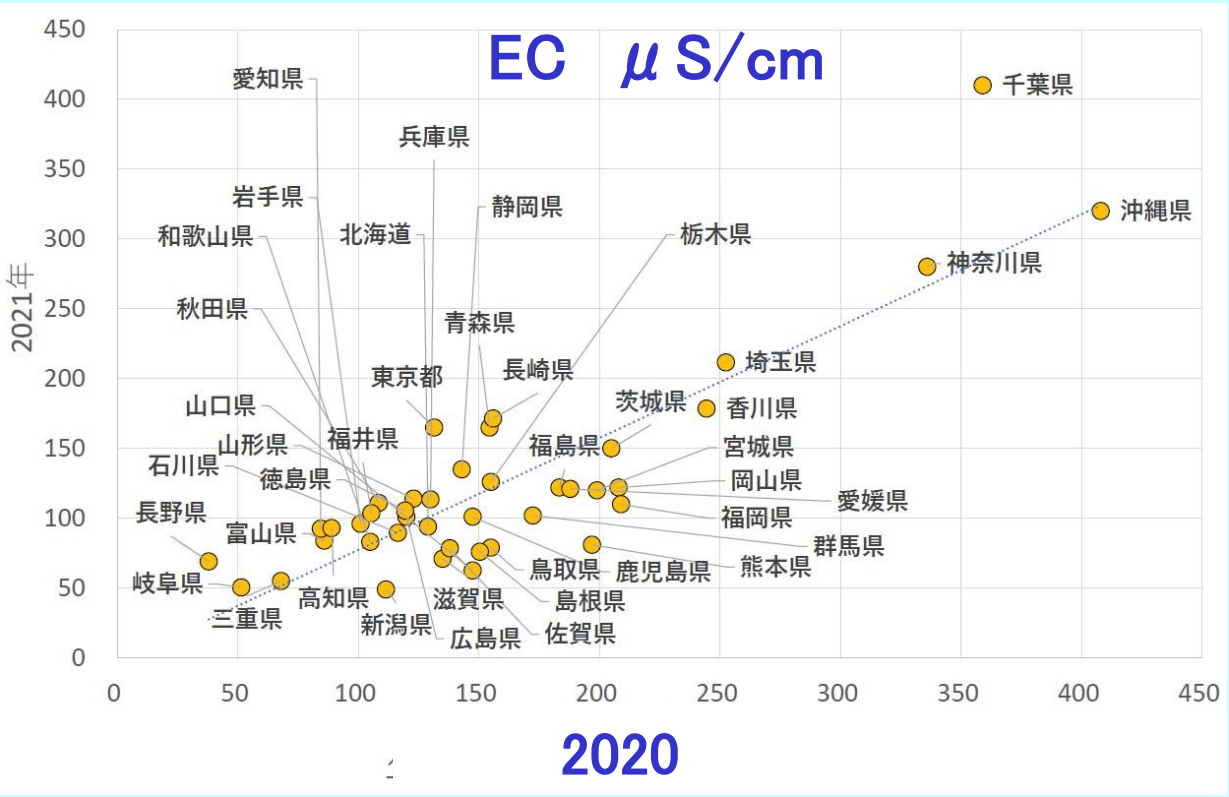

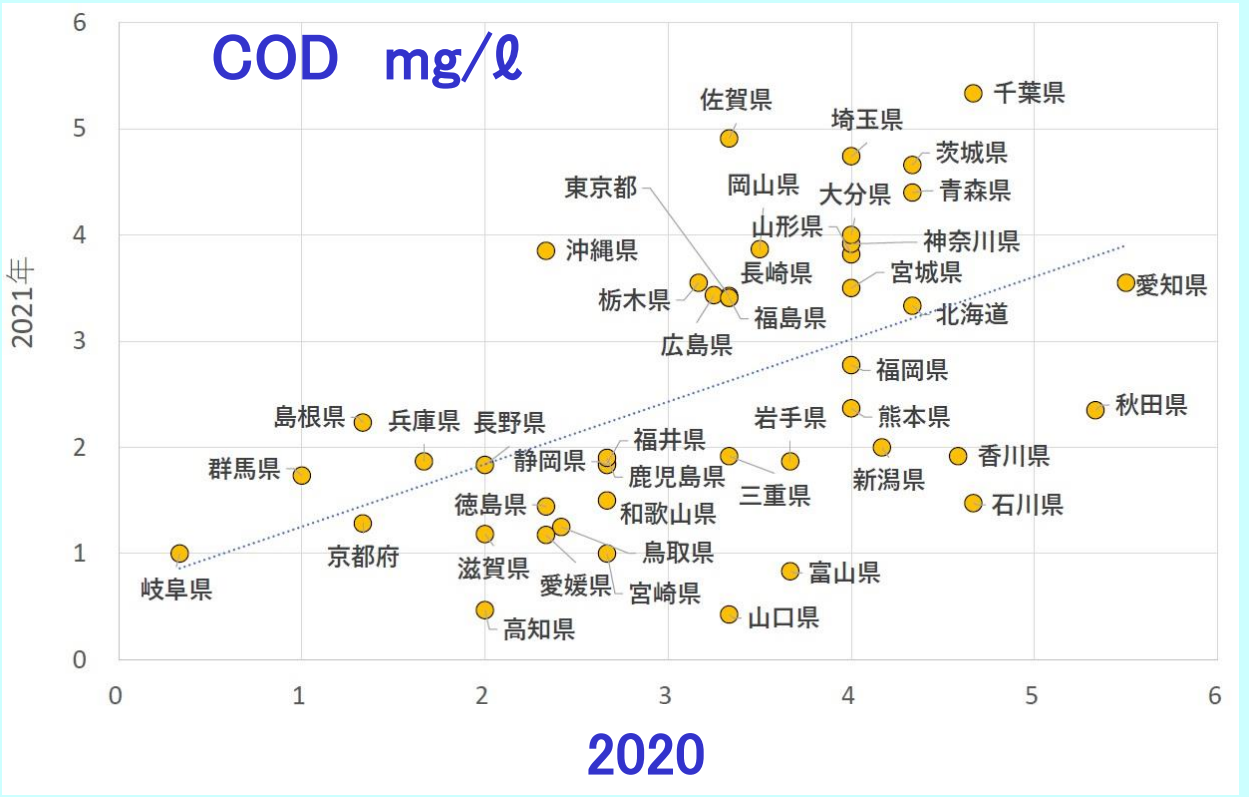

Even if the survey points are different, the annual correlation of the average water quality in each prefecture is high, and if there are 10 or more survey points, it can be said that there is representativeness.

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Relationship between EC and COD

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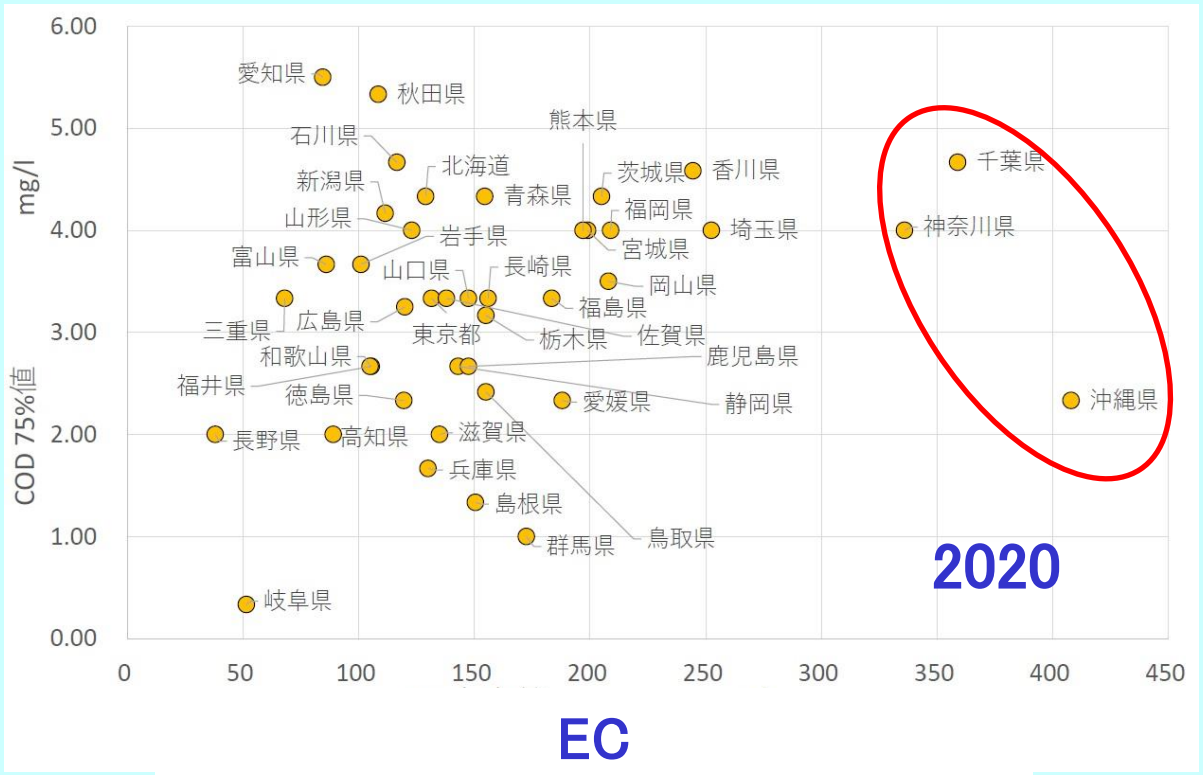

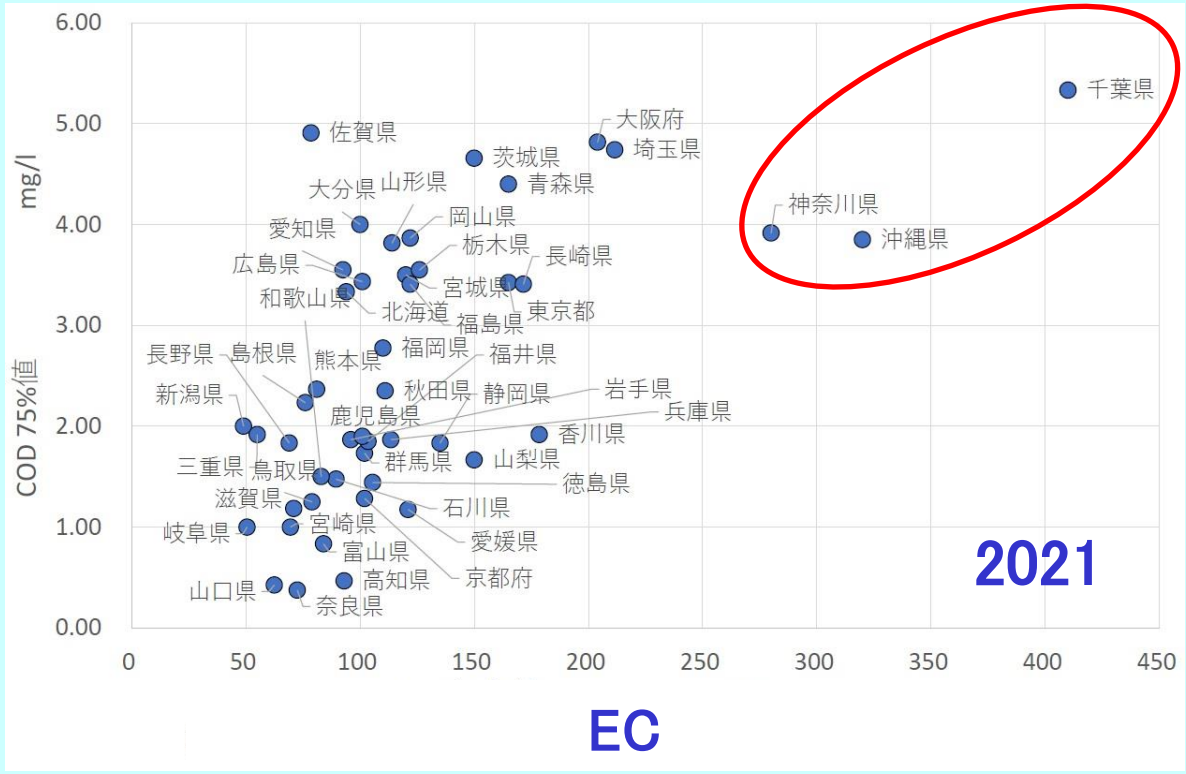

Low correlation in 2020, high in 2021

This seems to be due to differences in the survey location and the size of the catchment area. In the three prefectures, all values are always high

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Sewage treatment coverage rate and sewerage coverage rate

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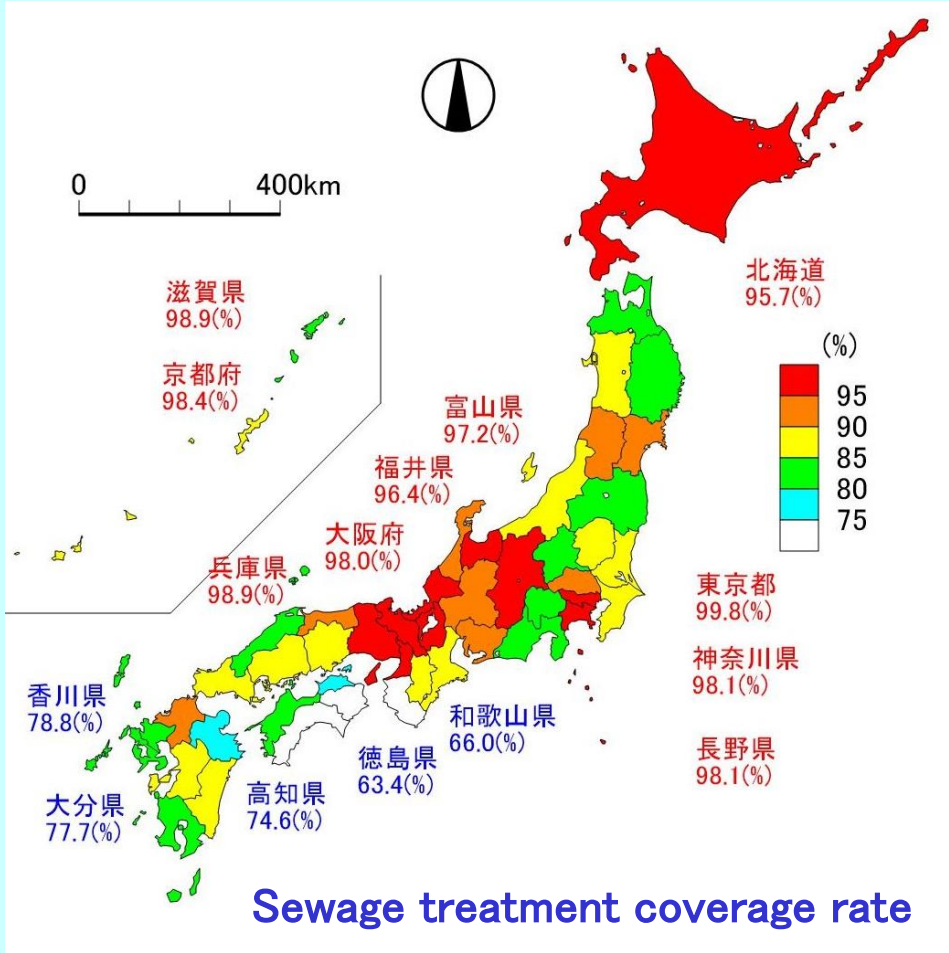

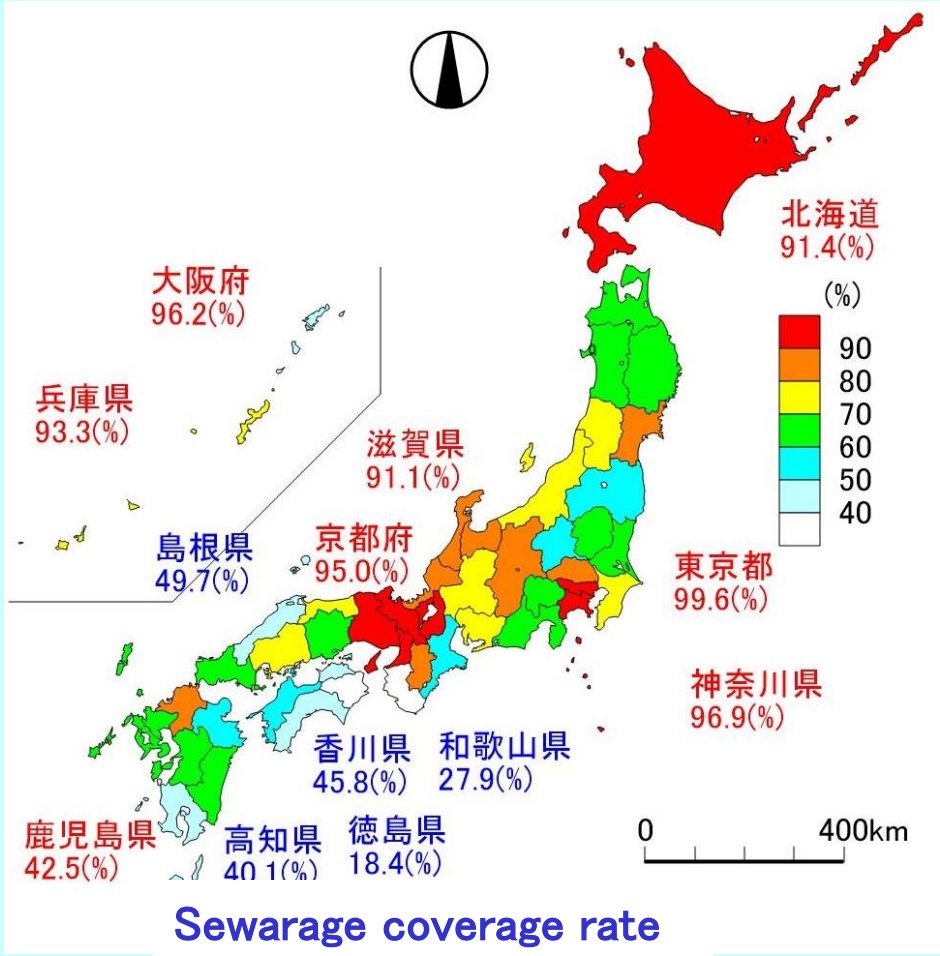

Not only urban areas, but also rural areas have high rates of sewage treatment

Relationship between sewage treatment penetration rate and EC/COD

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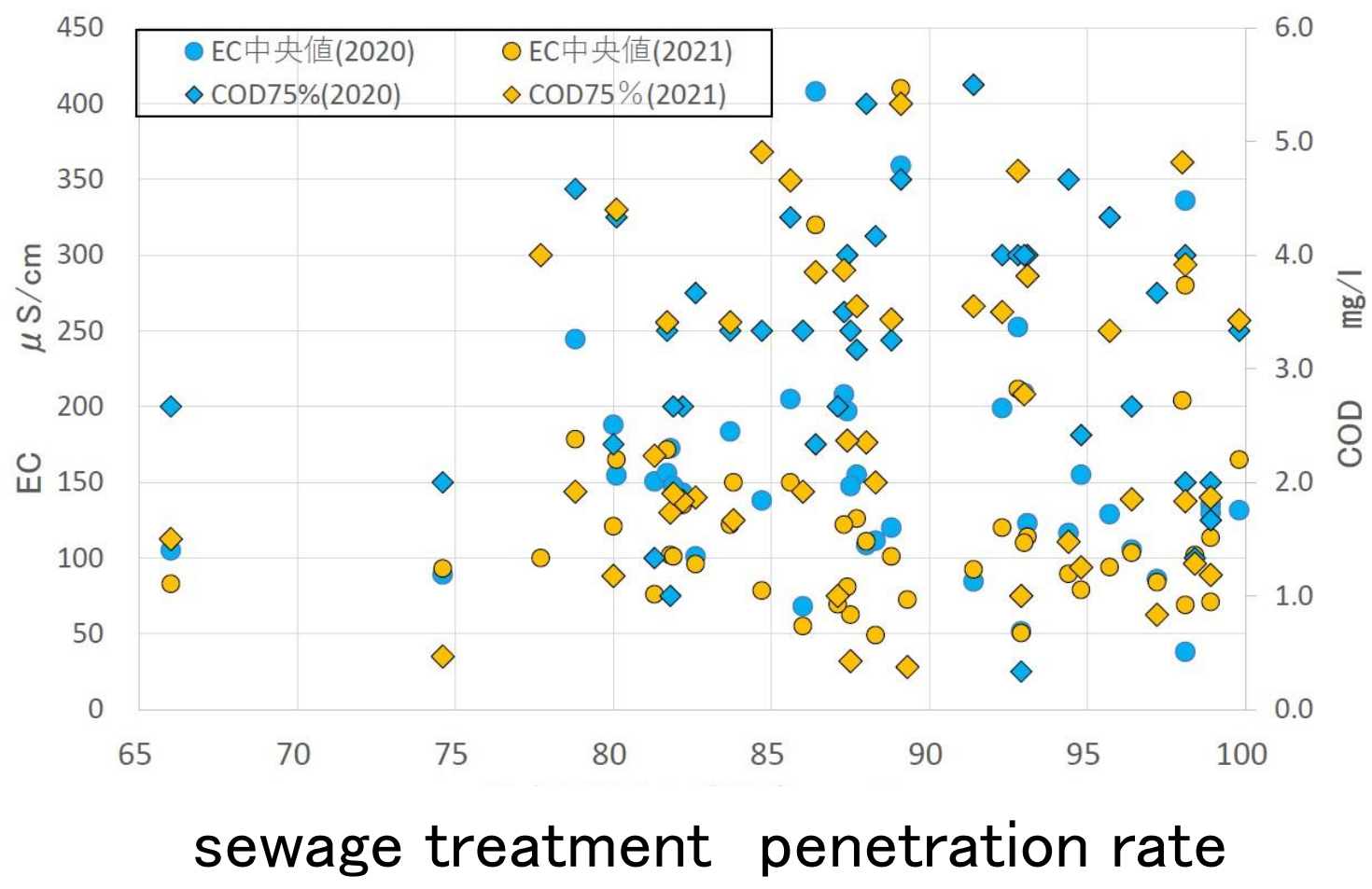

There is almost no correlation at the prefecture level

Why ？

There is a big difference in the sewage treatment penetration rate among municipalities

It is necessary to reorganize the survey results by municipality

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Number of survey points by municipality （2020）

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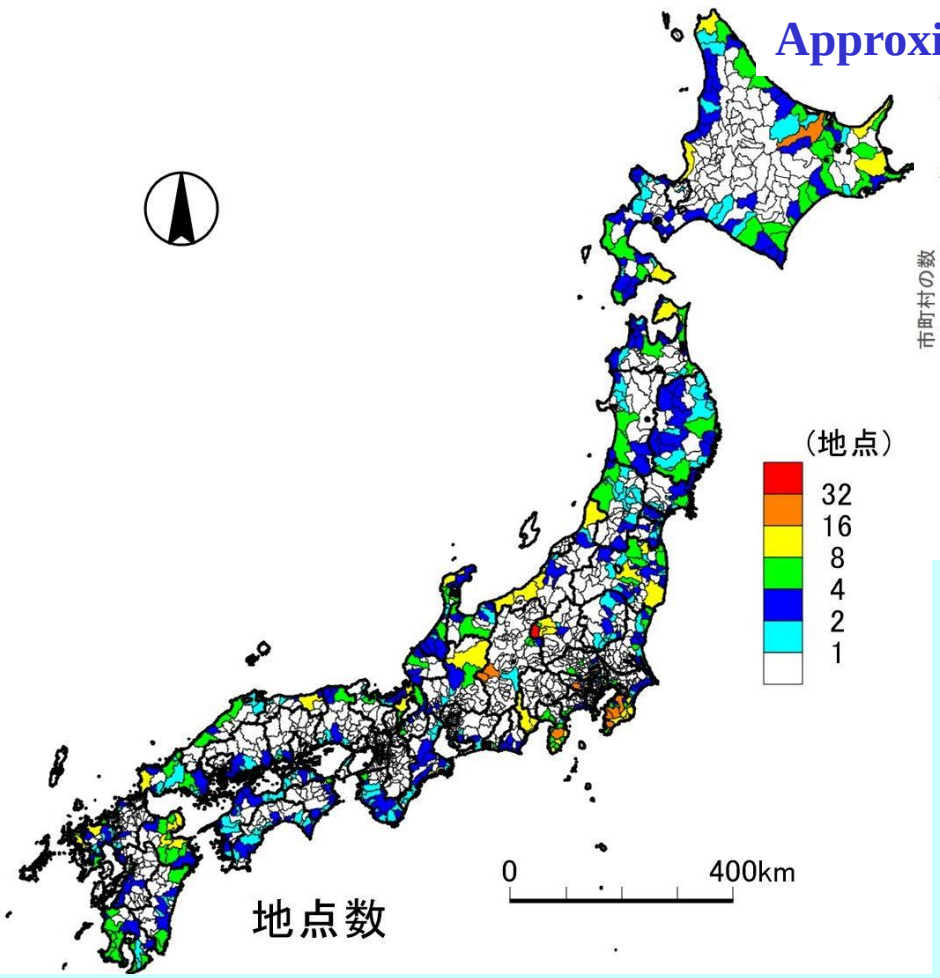
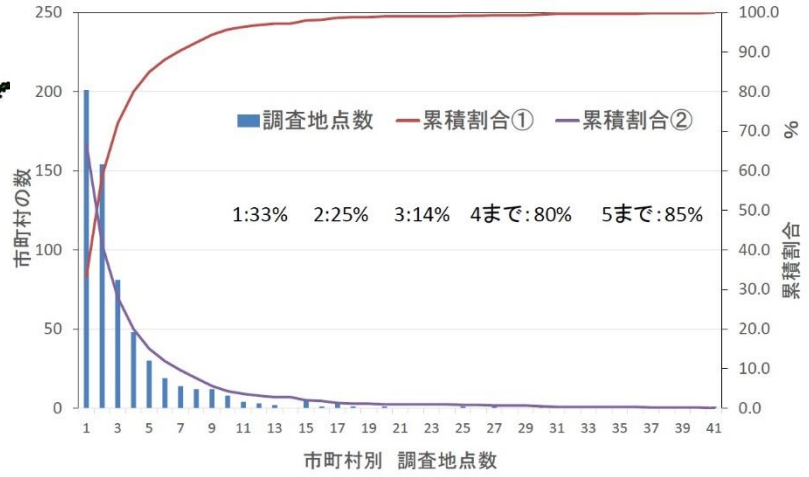
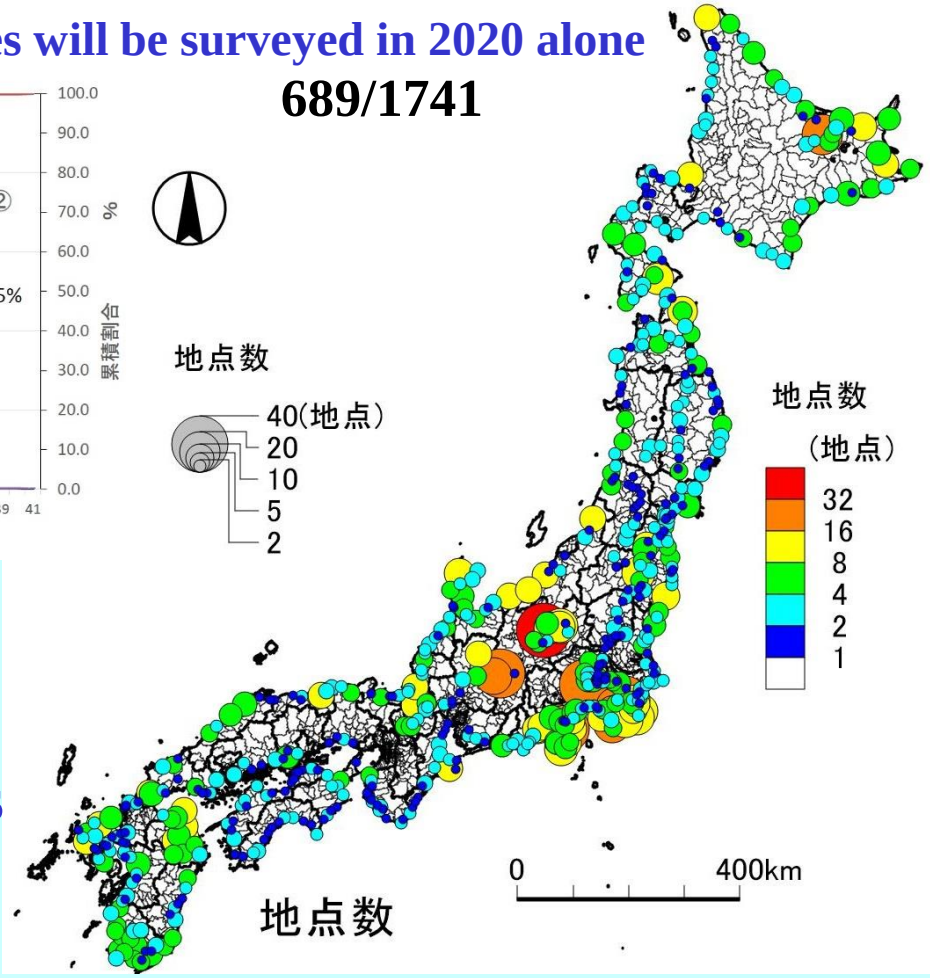
Approximately 40% of all municipalities will be surveyed in 2020 alone

689/1741





15% for municipalities with 5 or more sites,
42% for 3 or more sites



It is possible to survey three or more locations in all municipalities if surveys are conducted systematically over several years

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Distribution of average COD values by municipality

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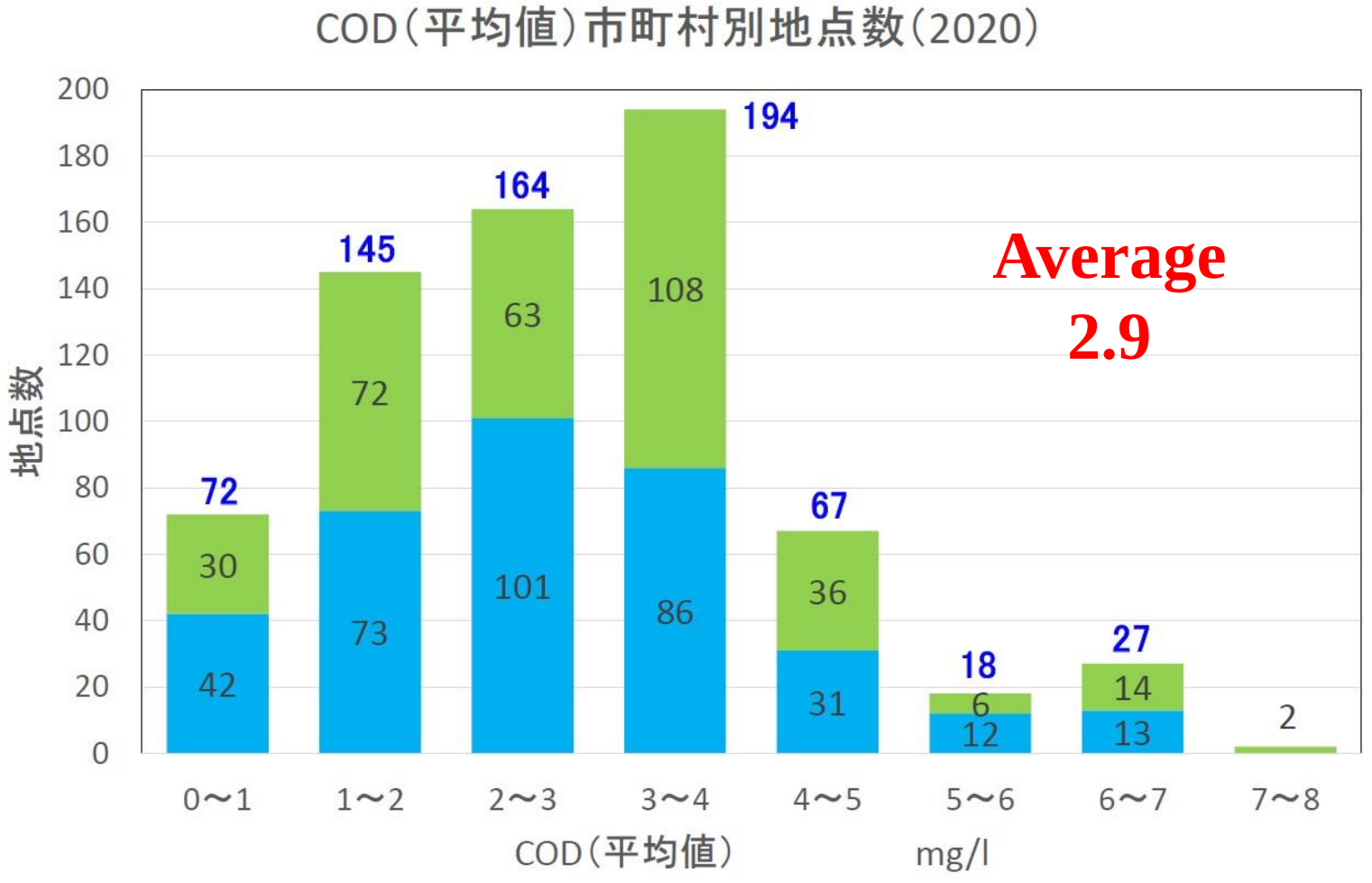

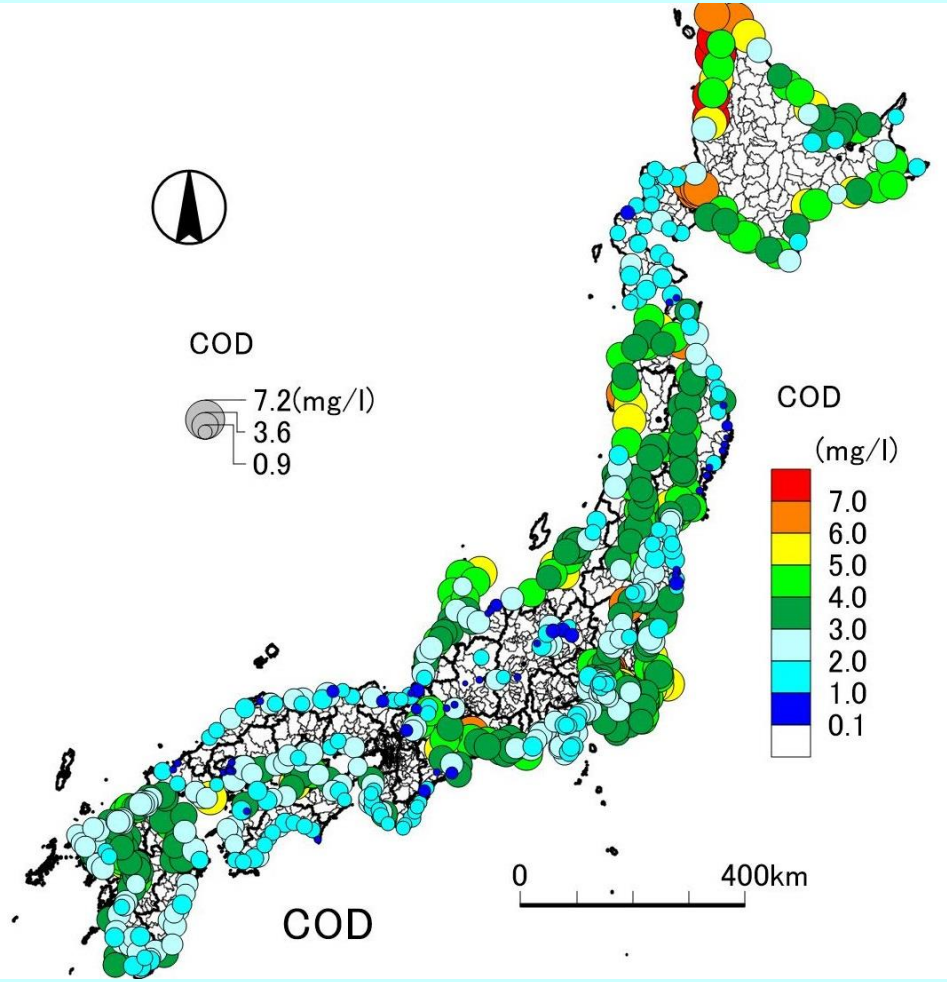

The average COD is 2.9, but about 17% of municipalities have a COD of over 4

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Distribution of average EC values by municipality

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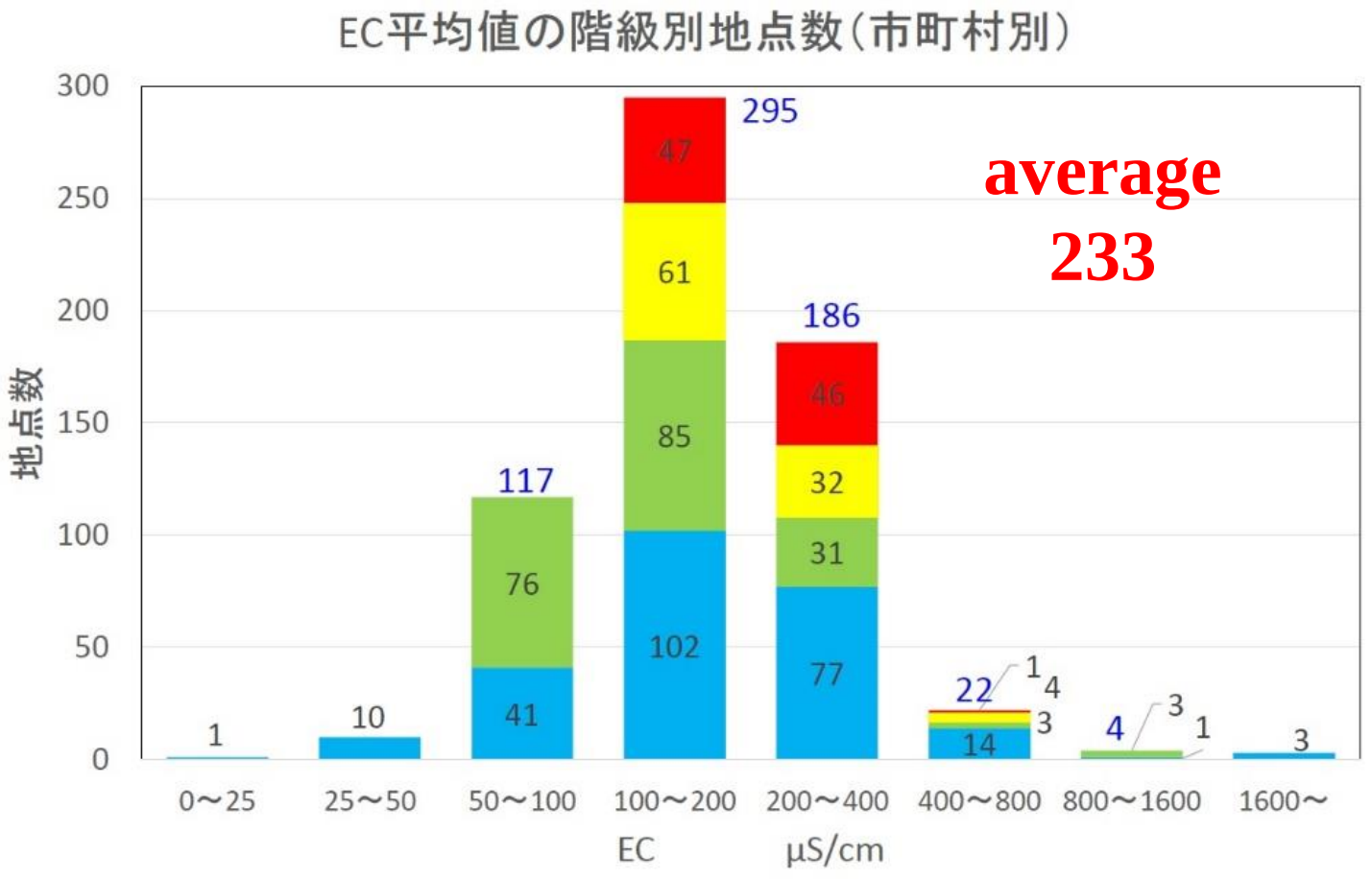

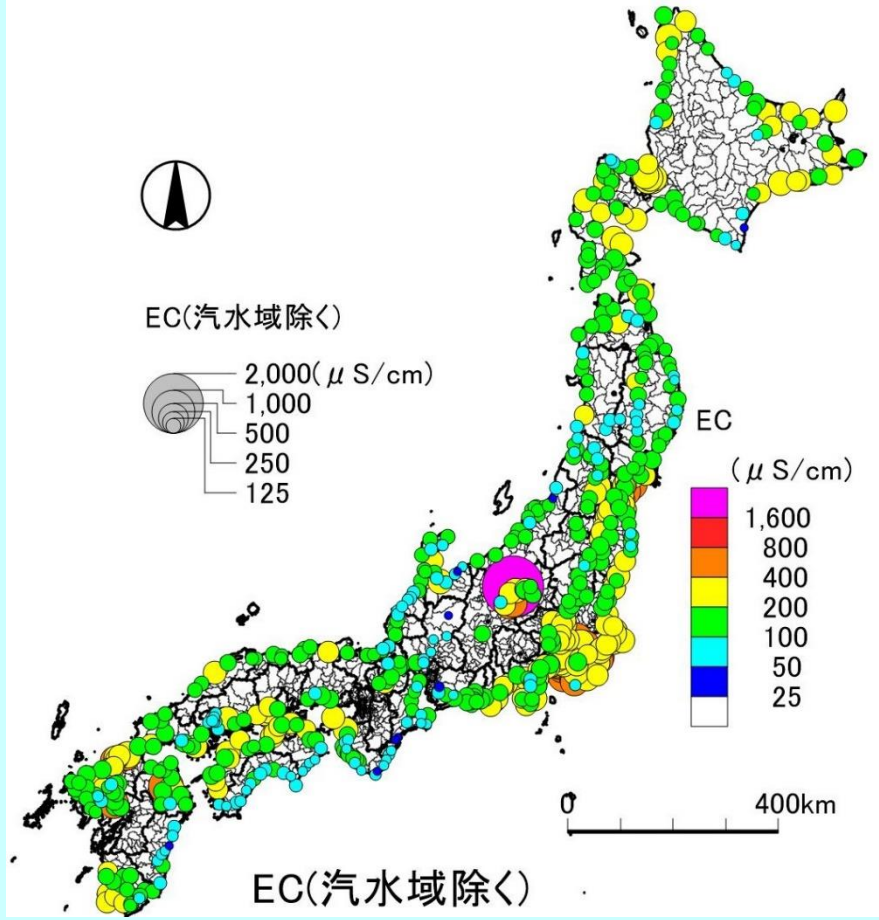

The average EC is 233 μS/cm, but there are some municipalities that exceed 800, which is thought to be the result of volcanic activity

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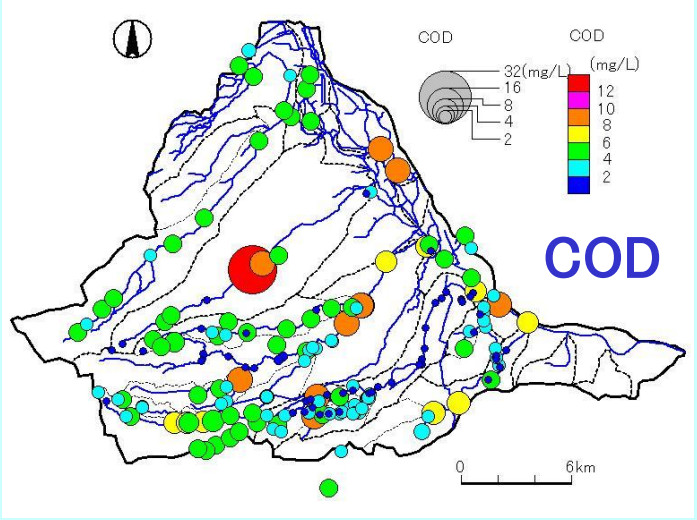
Case studies in the Shingashi River Basin in the suburbs of Tokyo

Since 2013, we have been receiving samples every year and conducting detailed analysis



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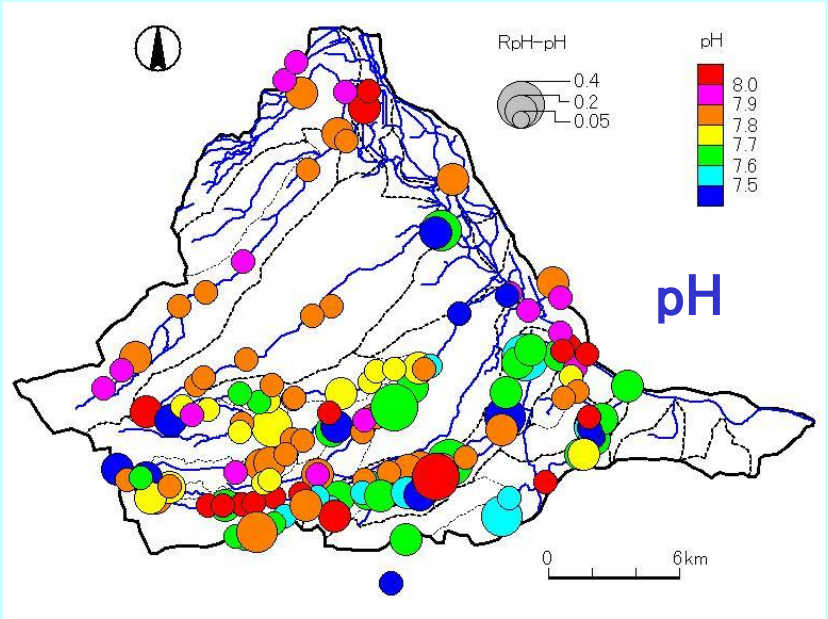

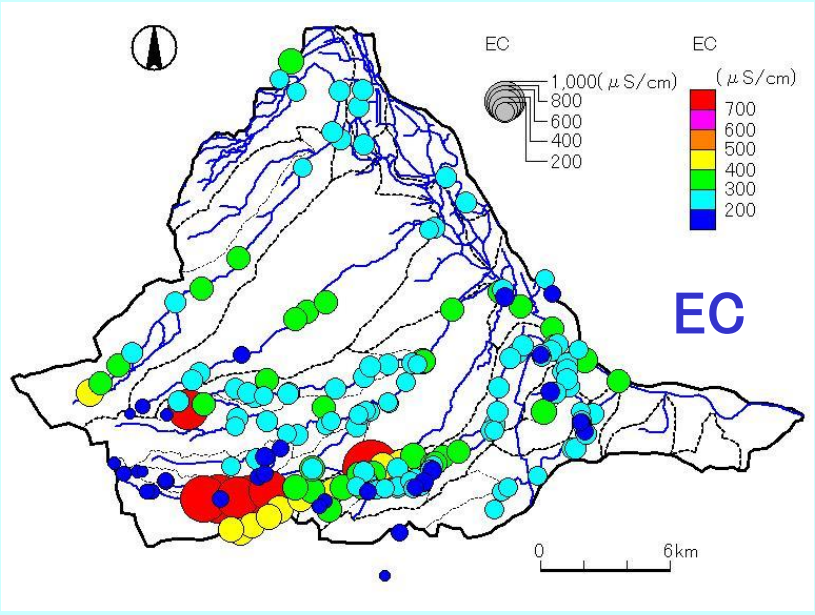

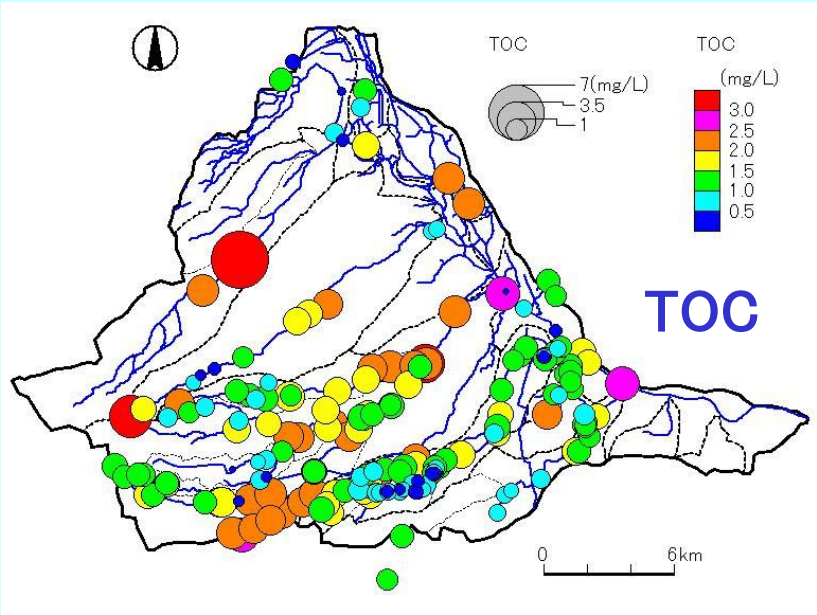

There are 10 survey points in the basin by the government, and it is possible to compare and examine the data of citizens and the data of our laboratory

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Detailed analysis using major dissolved component analysis results

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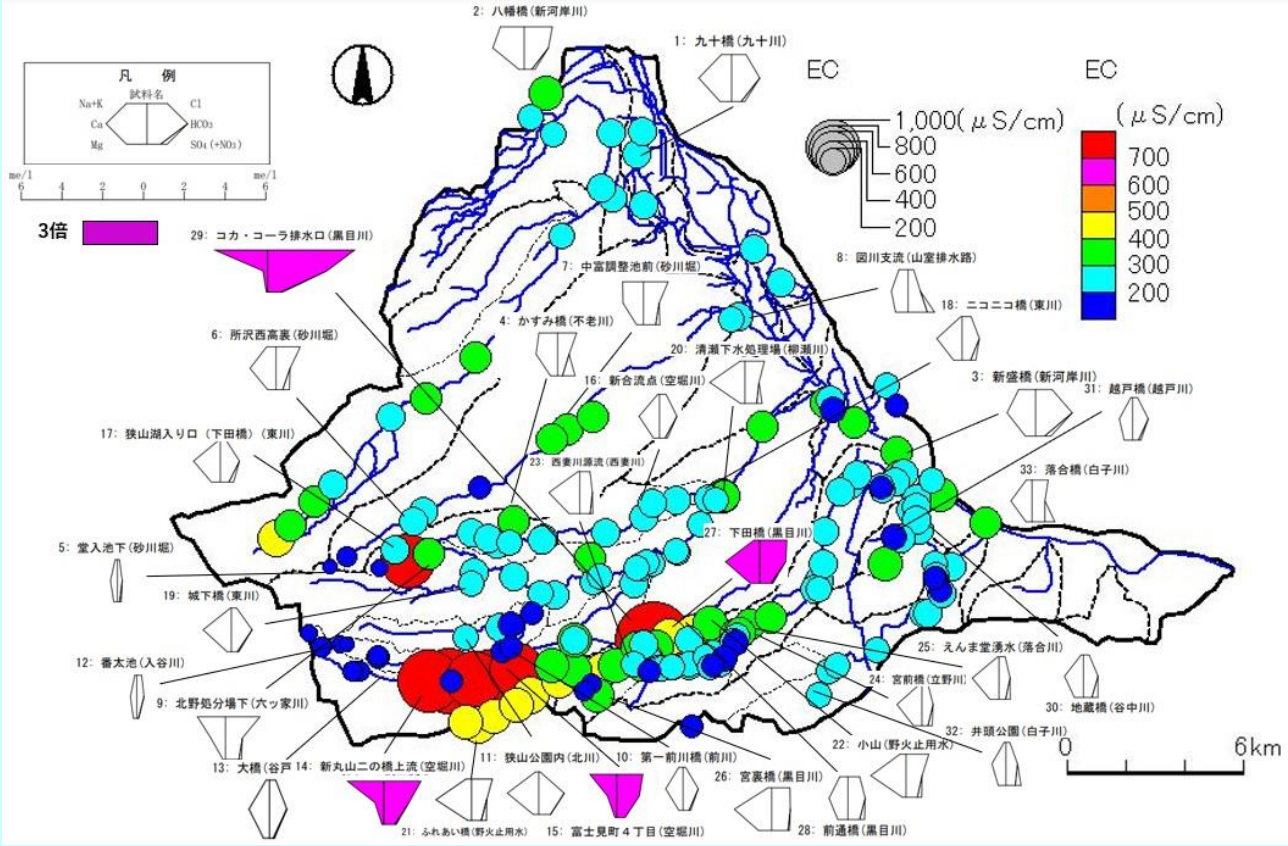

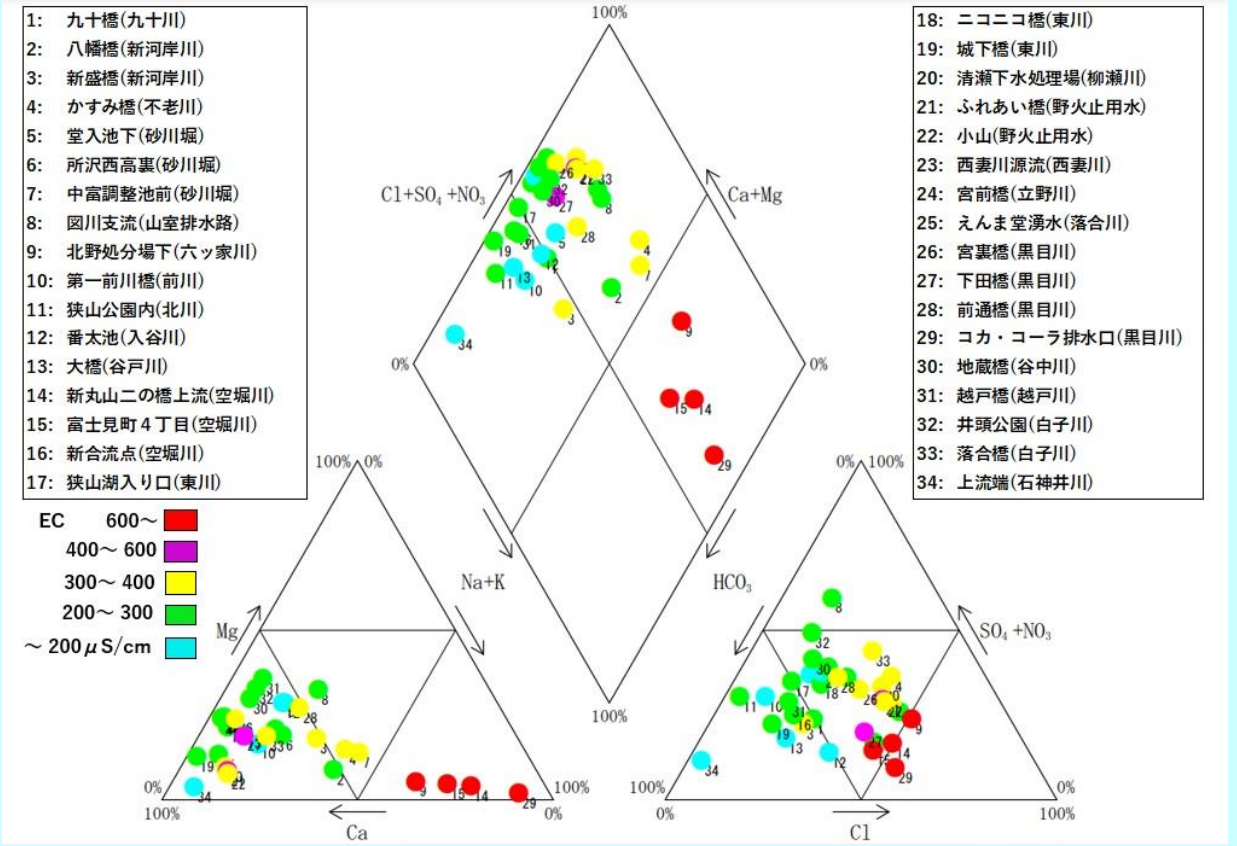

Pollution sources that could not be identified by government surveys or citizen surveys could be clarified, and proposals for water quality improvement could be made

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Conclusion

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① There are many problems in long-term analysis of river water quality in Japan

1） Lack of data before 1970 → Continue sorting from reports and papers
2） Observation points are biased → Collect and organize multiple survey results

② Problems with citizens' "National Simultaneous Survey of Familiar Water Environments"

1） The number of survey points by citizens is decreasing
2） It is necessary to increase the measurement items in addition to COD
(at least EC: electric conductivity)
3） Water quality analysis by sampling is required
→ We need the cooperation of research institutes other than ours

③ It is necessary to make a comparative study with other regions

1） Countries that have experienced deterioration and improvement in river water quality
2） Countries where river water quality is deteriorating significantly due to development, etc
3） Countries where there are concerns about deterioration of river water quality